American

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NOW!

Lectromelt* offers you a line of high frequency induction furnaces

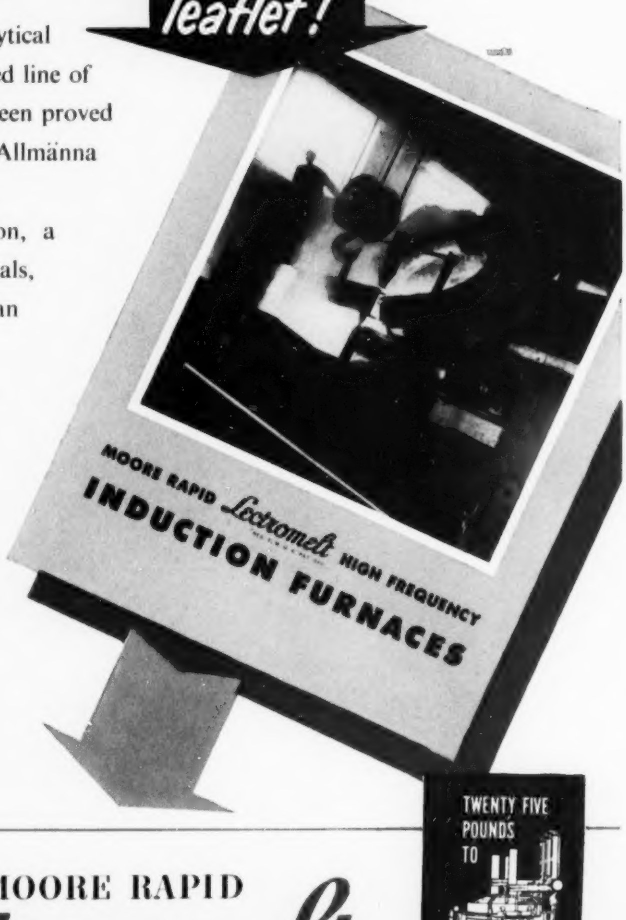
Proved in 27 years service!

Send for this leaflet!

Rapid operation, close temperature and analytical control combine to make this a highly respected line of High Frequency Induction Furnaces. They've been proved successfully since 1926 by the recognized Allmänna Svenska Elektriska Aktiebolaget in Sweden.

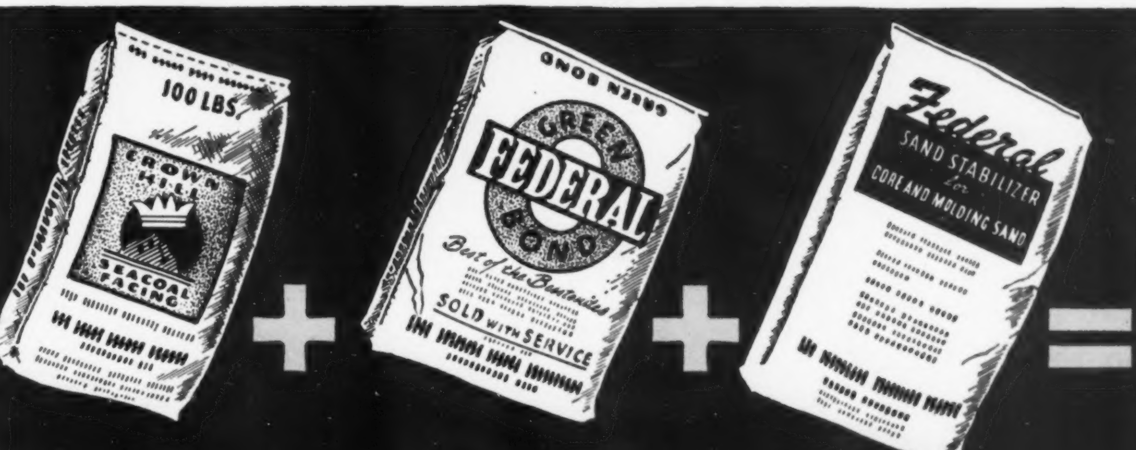
Pittsburgh Lectromelt Furnace Corporation, a leader since 1916 in the electric melting of metals, now adds this line of induction furnaces under an exclusive license agreement.

Melting, refining and holding steel and iron, and such nonferrous metals as copper and brass, are handled by these furnaces. Capacities range from 500 lbs. to 15 tons. For a Bulletin telling about these Lectromelt High-Frequency Induction Furnaces, write: Pittsburgh Lectromelt Furnace Corporation, 316 32nd St., Pittsburgh 30, Pennsylvania.



WHEN YOU MELT... MOORE RAPID Lectromelt

*REG. T. M. U. S. PAT. OFF.



EASY SAND CONTROL

We don't say it's as easy as A-B-C, but we do insist the seacoal-bentonite-stabilizer method will *simplify* sand control for you. And give you uniform, thoroughly satisfactory results!

By adding the above-mentioned materials to your sand in varying amounts, sand characteristics can be closely controlled and changed at will—to satisfy specific requirements. Carbon content is controlled by adding CROWN HILL SEACOAL. Green and dry strengths are varied by the addition of FEDERAL GREEN BOND BENTONITE. Greater flowability and better shakeout are obtained by adding FEDERAL SAND STABILIZER.

Common lake, river or beach sand can be used for replacement, without danger of grain size going out of balance—as will happen when offals of cores, made of coarse sand, mix with fines which must be used with emulsified asphalt or resin additives. And, (you'll like this!) *the cost of these three additives will not exceed $1.00 per ton of castings produced!*

So, for easy, efficient, economical sand control—change to the method of sand preparation already preferred by an overwhelming majority of iron foundries. We have a new bulletin with full details —write for your copy—TODAY!

CROWN HILL SEACOAL

Produced by *Federal* at Crown Hill, West Virginia. *High* in volatile combustible material, low in sulphur and ash content—basic requirements for a top quality seacoal. Ground or granulated to properly match the sand used.

FEDERAL GREEN BOND

Mined, processed and guaranteed by Federal. Unexcelled in uniformity and ability to develop green and dry strength. Possesses many times the natural bonding power of any other sand bond. Truly the best of the bentonites!

FEDERAL SAND STABILIZER

A processed cellulose sand additive whose high combustibility allows sand to expand evenly to eliminate casting defects. It increases sand flowability to provide better ramming conditions and attracts moisture to broaden the safe moisture range.
IMPORTANT . . . Federal Sand Stabilizer also holds lumpy shakeout to an absolute minimum!

FEDERAL

The **FEDERAL FOUNDRY SUPPLY** *Company*

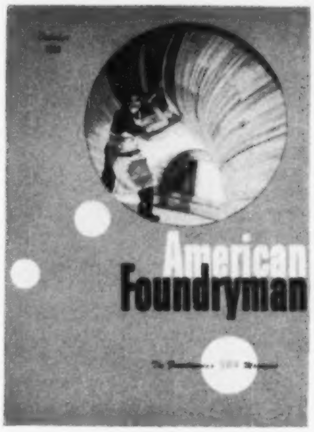
4600 EAST 71st STREET, CLEVELAND 5, OHIO

CHICAGO • DETROIT • MILWAUKEE • RICHMOND, VA. • ST. LOUIS • CHATTANOOGA • NEW YORK • UPTON, WYO.

American Foundryman

Volume 24 **October 1953** *Number 4*

Published by American Foundrymen's Society



Westinghouse craftsman fits wood piece into nearly completed pattern for part of giant steam turbine that will help power new atomic energy plant. When finished, huge wooden form will be used to produce sand mold. Casting from mold will form section of 200,000-kw steam turbine generator unit, one of several ordered by the Ohio Valley Electric Corp. to supply power for new atomic energy plant near Portsmouth, Ohio.

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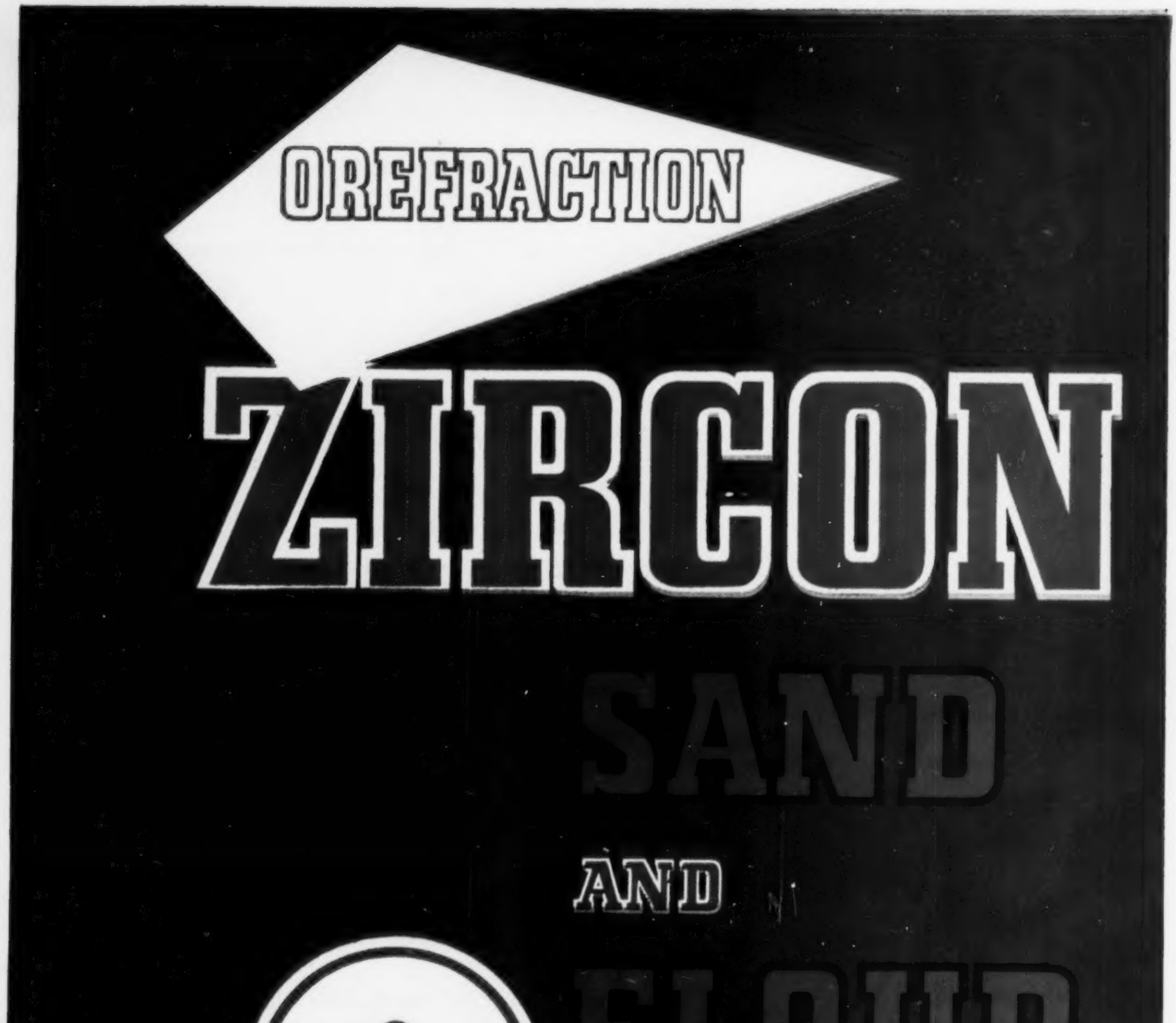
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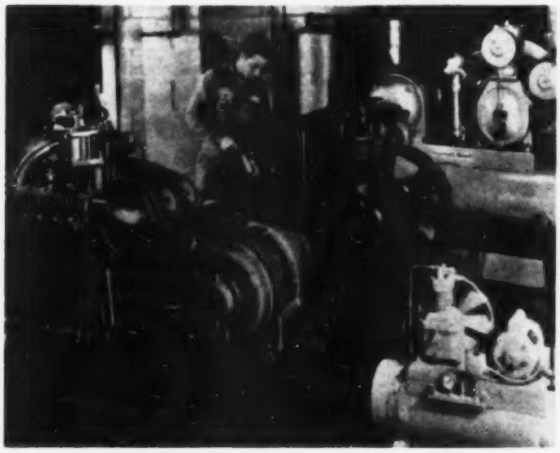
Here's How . . .



• • • industrial plants around the nation are making use of a service of Air Compressors & Motors, Inc. The firm offers "stand-by" replacement equipment, installed on short-term rental basis for period required to repair or replace original units. Company is said to maintain one of largest stocks of its kind in new and reconditioned air compressors.

For more data, circle No. 1 on card, page 17

• • • Ohio Steel Foundry, Springfield, Ohio, has replaced overnight air-drying and now dries silicone wash on molds for gear castings in 7½ minutes with Chromalox far-infrared electric radiant heaters. Single bank of 24 heaters, rated at 1.8 kw each, is suspended over conveyor carrying molds. During drying, heaters are lowered near molds, can be raised to ceiling.

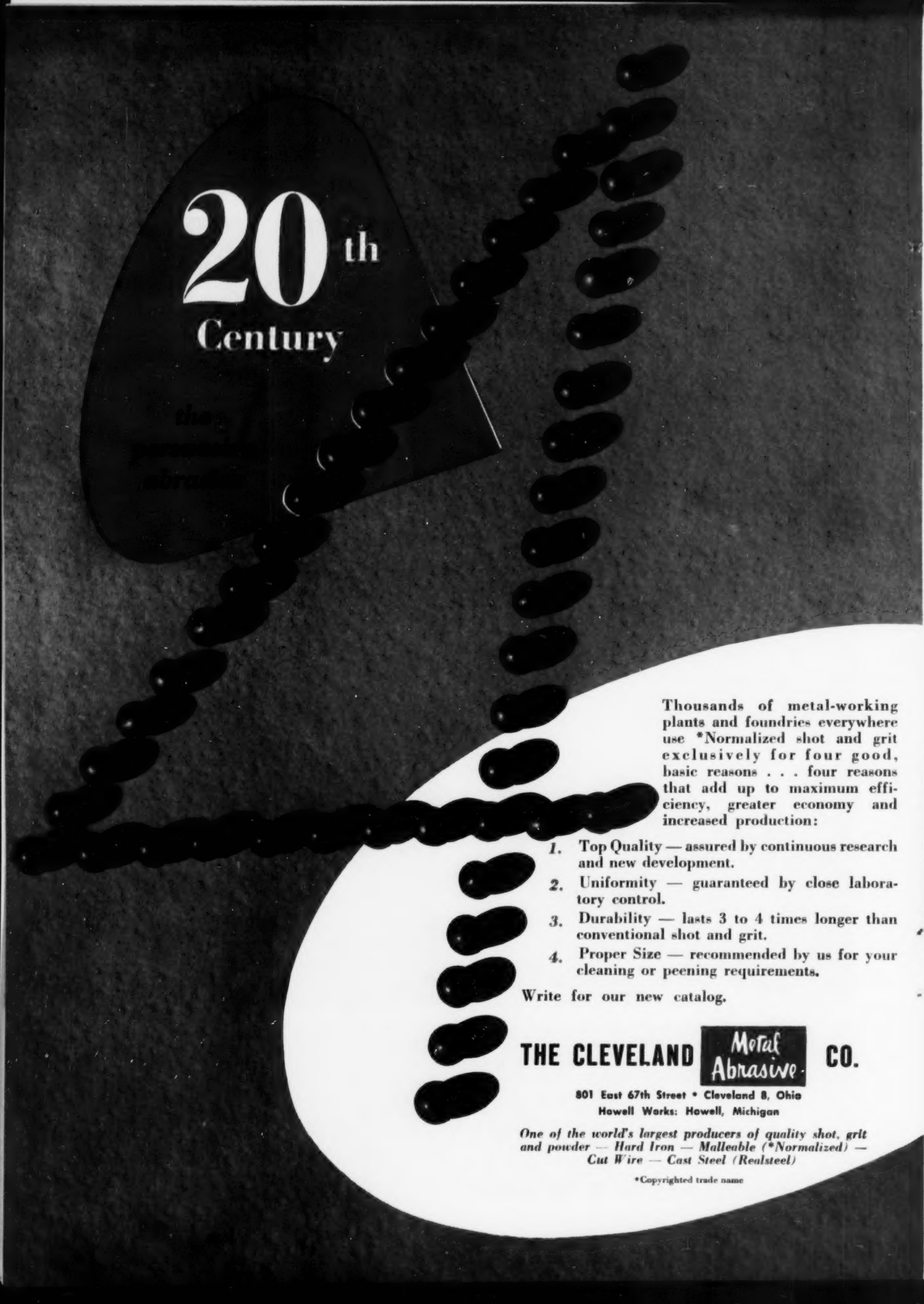
For more data, circle No. 2 on card, page 17

• • • foundries will find the Dryall rotary drum dryer useful in drying foundry sand which has been stored in outside stockpiles. Machine is highly portable, rubber tire mounted, and has capacity of 8 tons per hour. Air-cooled gasoline engine supplies power for easy operation in severe atmospheric conditions. Simple hydraulic jackleg support assists in hitching and unhitching machine for towing.

For more data, circle No. 3 on card, page 17

• • • the Symington-Gould Corp., Depew, N. Y., is storing and handling cores in effort to handle increased volume and variations in classes of product. High-lift Elwell-Parker platform truck is used to move racked cores to molding department, where cranes deliver filled racks to proper molding unit. Cores for certain foundry jobs are segregated in designated core storage areas for easier and quicker delivery.

For more data, circle No. 4 on card, page 17


20th
Century
Thousands of metal-working plants and foundries everywhere use *Normalized shot and grit exclusively for four good, basic reasons . . . four reasons that add up to maximum efficiency, greater economy and increased production:
1. Top Quality — assured by continuous research and new development.
2. Uniformity — guaranteed by close laboratory control.
3. Durability — lasts 3 to 4 times longer than conventional shot and grit.
4. Proper Size — recommended by us for your cleaning or peening requirements.
Write for our new catalog.
THE CLEVELAND Metal Abrasive CO.
801 East 67th Street • Cleveland 8, Ohio
Howell Works: Howell, Michigan
One of the world's largest producers of quality shot, grit and powder — Hard Iron — Malleable (*Normalized) — Cut Wire — Cast Steel (Realsteel)
*Copyrighted trade name

Talk of the Industry

COMBINING THE C AND D PROCESSES, a foundry is preparing to produce sand shells to close dimensional tolerances both inside and outside. Object is to be able to insert the shells in metal molds. Shells will be blown with a C process-mix(sand will be precoated with resin) though a D Process pattern and into a core box. Curing will take place in electrically-heated core boxes, one box curing while the other is under the blow head.

GRAY IRON BACKING for freight car bearings is highly successful according to Gray Iron News. Advantage lies in protection of the journal when the babbit lining melts out under influence of a hot box. Requirements include over 40,000 psi-tensile strength and rigid dimensional tolerances. Foundries producing the bearings will need special equipment for cleaning the gray iron castings in molten alkaline salts and for tinning and babbitting.

100,000 PSI TENSILE FOR ALUMINUM is rumored to have been developed on a laboratory scale. Secret is reported to be in vacuum melting and casting, and in elimination of small amounts of impurities.

CONTROLLED CARBON in titanium is reported to be possible thru the use of a new furnace. A titanium electrode and water-cooled copper crucible give carbon at any desired level down to the amount inherent in the sponge material. Yield is high. Elimination of carbon contamination results in improved machining and welding characteristics and increased impact strength.

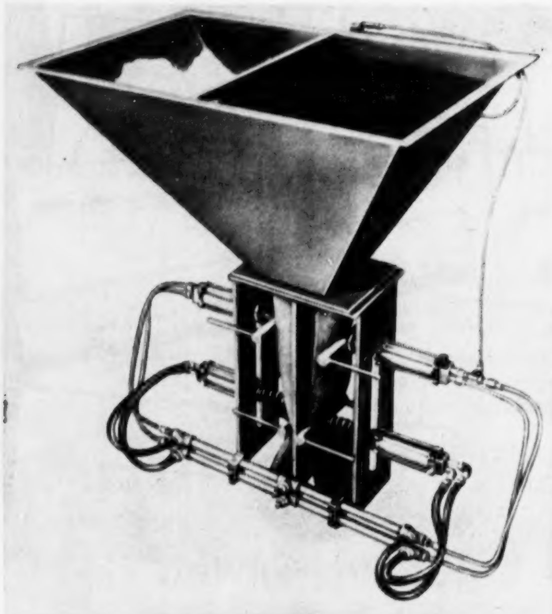
ONE CASTING IN 60,000 scrapped due to green sand troubles is the recent record of a midwest steel foundry. Scabs and erosion are virtually nonexistent since this shop instituted pH control of molding sand. Mold washes, thick and high in viscosity, become more penetrating and adherent when the pH is adjusted with the right chemical additives.

OLD MOLDER'S PRACTICE of beating on the side of a flask during casting solidification has been brought up to date with recent work on influencing casting feeding by means of supersonic vibration.

Products & Processes

For additional information,
use postcard at bottom of page 17

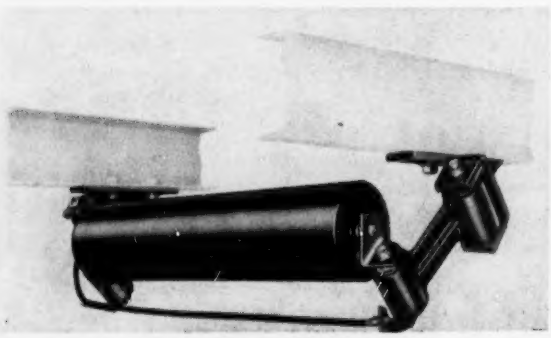
(continued on page 17)



Dispensing Hopper

New "Bondadder" is a double hopper that dispenses into a mill a measured volume of clay, bentonite, cereal, wood flour, silica flour, or seacoal. Additives are measured in large-diameter rubber tubing automatically pinched and opened by air-operated seals. Material is stored in 150-lb hoppers. *H. W. Dietert Co.*

For more data, circle No. 5 on card, page 17



Return Idler

New Rex Belt training return idler provides automatic alignment for return belts in lengthy conveyor systems. *Chain Belt Co. of Milwaukee.*

For more data, circle No. 7 on card, page 17

Automatic Dumping Clamp

Heavy loads, such as the brass cartridges shown here and weighing 2500 lb, are dumped automatically through hoppers into two-wheel steel carts by new roll-over attachment for industrial trucks. The clamp, mounted on a revolving carriage, has extra pair of forks to grasp the container as it is tipped 180 degrees for emptying. *Automatic Transportation Co.*

For more data, circle No. 6 on card, page 17

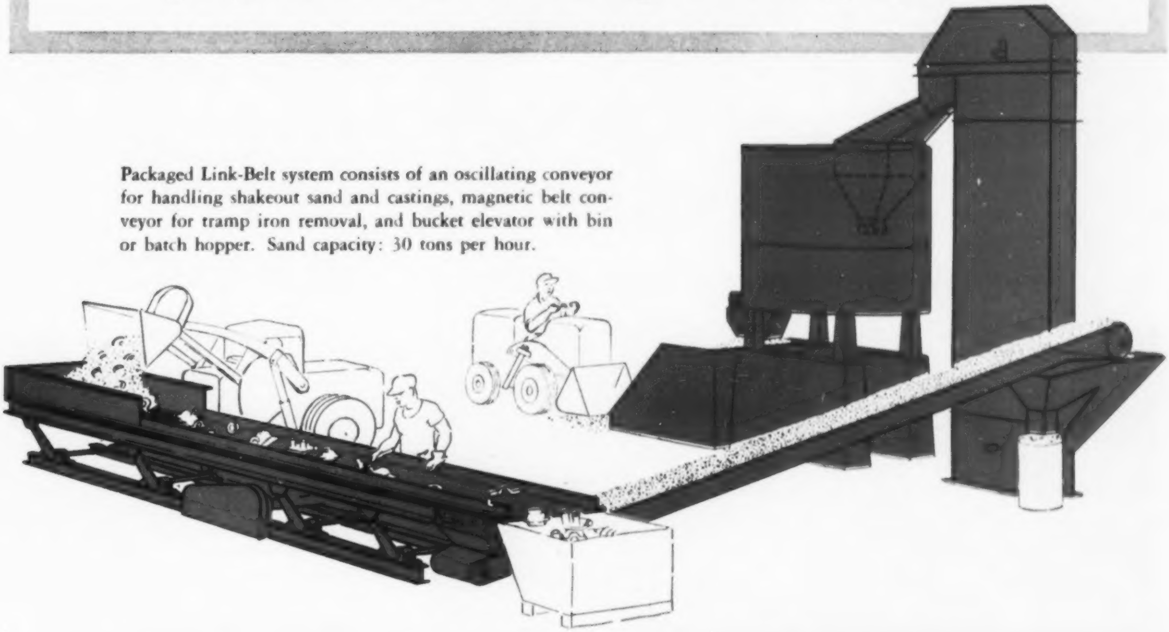
Flaw Finder

This Penetrant Dye inspection process is claimed to be efficient, convenient, and economical in readily locating defects in all metal, glass, and most plastic surfaces. Foundries should find it useful in checking either ferrous or non-ferrous castings to assure quality products. *Met-L-Chek Co.*

For more data, circle No. 8 on card, page 17

Now small foundries cut costs

with pre-engineered, packaged sand preparation and casting handling system



Packaged Link-Belt system consists of an oscillating conveyor for handling shakeout sand and castings, magnetic belt conveyor for tramp iron removal, and bucket elevator with bin or batch hopper. Sand capacity: 30 tons per hour.

LINK-BELT combines ruggedness, compactness and low cost in a modern, mechanized unit

If you have less than 100 employees in your foundry, here's the ideal answer for increased output of better castings . . . at lower cost. Link-Belt has applied its broad experience in foundry handling problems to produce a compact, pre-engineered system that revolutionizes small foundry casting operations. It means "big foundry" organization and efficiency, regardless of the volume of your production.

Through modern sand control, this unit will quickly pay its way by reducing labor costs and improving casting quality. Equally important, systematic handling of sand and castings assures better working conditions and a cleaner foundry . . . eliminates wasted floor space.

Whether your foundry is large or small—gray iron, steel, malleable or non-ferrous—Link-Belt engineering and equipment fill the bill. A foundry specialist will be glad to work with you or your consultant. Your nearest Link-Belt office welcomes the opportunity to give you complete information.

Link-Belt Oscillating Conveyor has perforated trough at feed end to act as shakeout section and plain section of trough for spruing and sorting of castings. Air cylinder operates damming gate between sections to hold back castings for proper shakeout action.

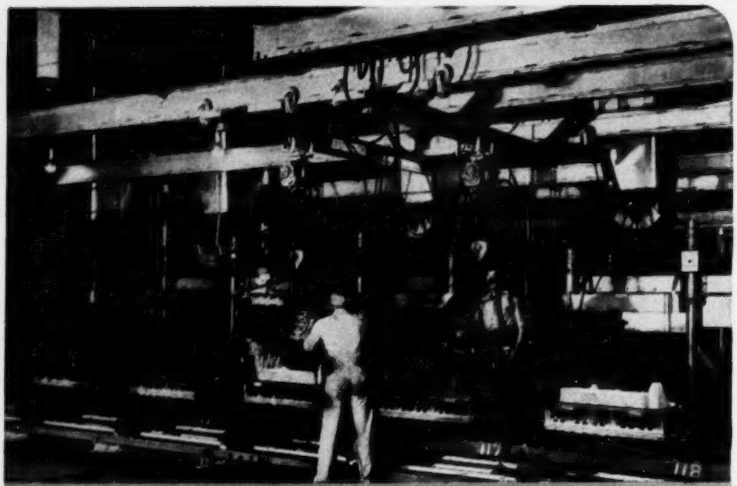
13,278

LINK-BELT

CONVEYORS AND PREPARATION MACHINERY

FEMA

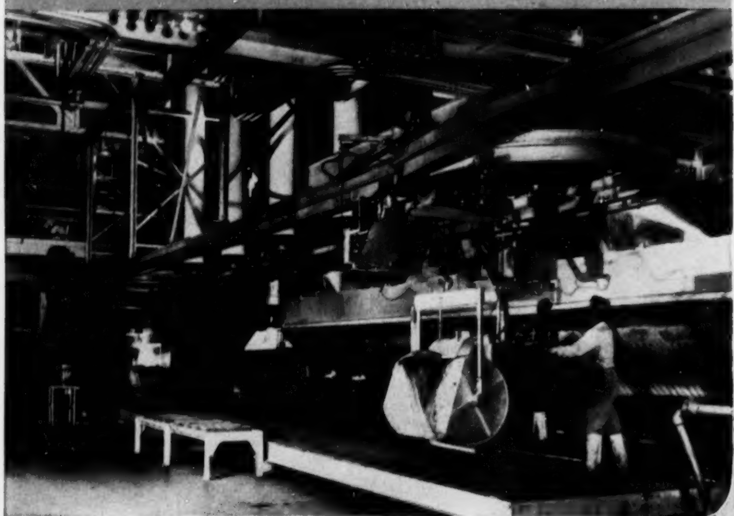
LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle; Scarboro, Toronto and Elmira, Ont. (Canada); Springs (South Africa); Sydney (Australia). Sales Offices in Principal Cities.



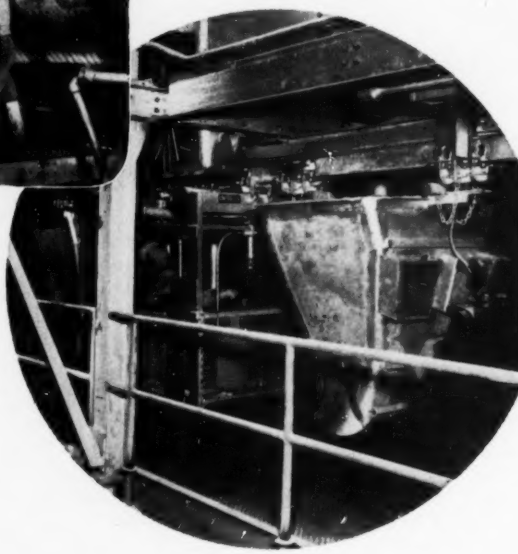
American MonoRail Cranes handle flasks through core setting to closing of cope and drag. 140 of these 1-ton cranes operate on 5800 feet of American MonoRail Girder Rail on the flask preparation line.

AMERICAN MONORAIL

Moves Core Sand, Flasks, Ladles in the NEW FORD FOUNDRY



At the pouring loops, ladles on American MonoRail carriers move at the same rate as the flasks for quick, easy pouring. 41 carriers operate on 1250 feet of Shielded Rail Master Track to complete this operation.



American MonoRail equipment in the new Ford Cleveland Foundry moves core sand from hoppers to core blowers by means of 3 cab operated carriers on a Shielded Rail Master MonoRail System which includes 950 feet of track and 10 motor operated 2-way glide switches.

Other systems, as illustrated, handle flasks and ladles over extensive American MonoRail Installations.

Experienced engineers will be glad to consult with you on any handling problems in your foundry. Write for the new "Case Study File" showing other applications.

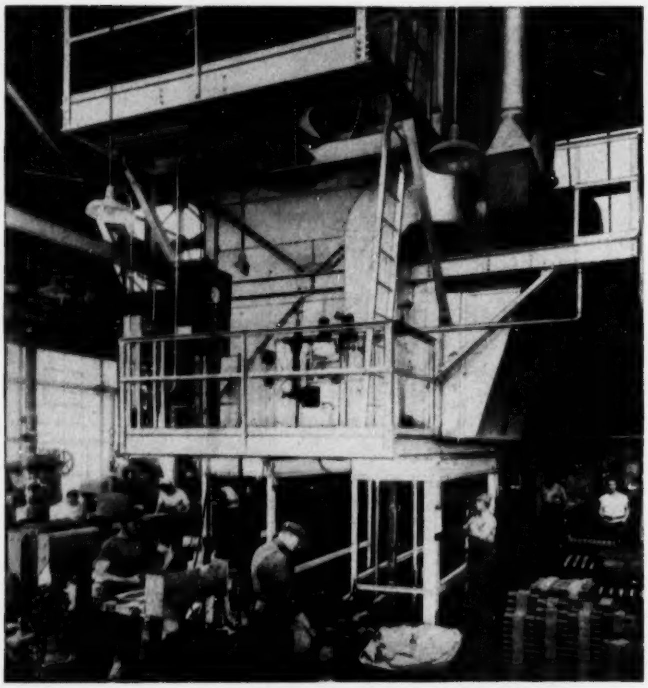
THE AMERICAN MONORAIL COMPANY

13122 ATHENS AVENUE **CLEVELAND 7, OHIO**

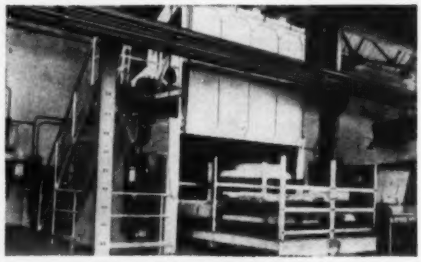
Repeat orders for

COLEMAN OVENS

prove outstanding performance



Coleman Tower Oven at Wells Manufacturing Co.



Coleman Car-Type Core Ovens
at Pettibone-Mulliken Co.

Coleman Car-Type Mold Oven
at The Bullard Co.

Battery of Coleman Transrack Core Ovens
at The Crucible Steel Castings Co.

You should get all the facts concerning the core and mold ovens you expect to install . . . because the right ovens will increase your production and your profits. Over 80% of Coleman Ovens are "repeat orders" from past customers . . . proving performance to *complete satisfaction*. Coleman Ovens are the choice of leading firms in every branch of the foundry industry from small shops to large production foundries. You get over 50 years of know-how and experience in every Coleman Oven, so why gamble with inferior designs? Coleman Ovens of proved performance cost no more . . . and pay for themselves quickly out of savings in fuel, labor and increased production. Get the facts today . . .

WRITE FOR BULLETIN C

A COMPLETE RANGE OF TYPES AND SIZES

for every core baking and mold drying requirement:

- Tower Ovens
- Horizontal Conveyor Ovens
- Car-Type Ovens
- Transrack Ovens
- Rolling Drawer Ovens
- Portable Core Ovens
- Portable Mold Dryers

FEMA

THE FOUNDRY EQUIPMENT COMPANY

1831 COLUMBUS ROAD CLEVELAND 13, OHIO

● ***world's oldest and largest foundry oven specialists***

Products & Processes

Fill out postcard below for complete information on products listed in these pages.

Continued from page 10

CONVENIENT FORM FOR ORDERING INFORMATION

Quality Control Aid

A new circular slide rule, Qualit-rule, aids in applied statistics, particularly industrial quality control. Manufacturer says rule presents in one setting the upper and lower limits for number of defectives or rejects to be expected in a sample of given size, under certain conditions. Limits depend on sample size and overall average. Slide rule covers sample sizes from 2 to 1000, averages from .3 to 20 per cent, upper limits from 2 to 200 units, and lower limits from zero to 50 units. All figures directly read off, without any intermediate computation. For any one set average, limits can be read for all sample sizes without moving slide rule. Seven in. in diameter, rule is made from sheets of non-warping, dimensionally stable vinylite. *American Hydromath Corp.*

For more data, circle No. 9 on card

Plastic Casting Sealant

Claimed to have outstanding sealing ability, Imprex is a new plastic sealant for impregnating pressure castings. It is said to permanently seal excessive "leaker" and even "squirter" pressure castings, with penetration properties which enable it to saturate all porous areas. Evaporation loss is minimized, as is shrinkage, which enables the seal to maintain its bond to casting as it hardens. May be washed off with water; no expensive, dangerous solvents required. *Tincher Prods. Co.*

For more data, circle No. 10 on card

Air-Operated Scaler

New No. 326 scaler is designed primarily for cleansing rust, paint and scale from boilers, tanks and structural steel. Scaler has three piston type units which operate with rotary motion. Fast chipping action makes it ideal for cleaning inside of large castings in addition to other uses. *Thor Power Tool Co.*

For more data, circle No. 11 on card

Screen Separator

Built to use 24-in. diameter foundry riddle, new medium-size screen separator is operated by ball bearing ac motor through novel design nylon eccentric bushing. Bronze bushings used throughout. Dimensions of machine are 37 in. x 29 in. x 24 in. high. Screen mesh sizes furnished according to your specifications. *Rampe Mfg. Co.*

For more data, circle No. 12 on card

Oil Resistant Flooring

An improved oil and grease resistant flooring, known as Sylox, is a type of oxychloride cement that is a complete flooring "unit" in itself. Each unit proportioned and packaged at the factory, designed to cover a pre-determined area at an average depth of only one-half inch. Product has varied uses in industrial plants and factories where oil and grease present a serious health and safety problem. May be applied directly over old surfaces. *United Laboratories, Inc.*

For more data, circle No. 13 on card

Reader Service Dept.

53|10

Please send me detailed information on the Products and Processes.

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18

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TITLE

COMPANY

ADDRESS

CITY AND ZONE

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BUSINESS REPLY CARD

First Class Permit No. 14680, Sec. 34.9 P. L. & R., CHICAGO, ILL.

Reader Service

AMERICAN FOUNDRYMAN

616 S. Michigan Avenue

Chicago 5, Illinois

Free Foundry Information

For additional information use postcard at bottom of this page

Portable Space Heaters

This 36-page booklet describes the advantages and disadvantages of the various types of portable space heaters. The booklet points out that heat output and portability are not the only major factors to consider when buying portable air heaters for temporary heating use such as spot heating, equipment preheating and special applications. The subject of safety is fully covered in the booklet. *American Air Filter Co.*

For more data circle No. 14 on card

Crane Truck Detailed

An electric-powered, two-wheel drive crane truck is detailed in a two-color folder now available. The truck, type CX-4, has four-wheel steer, has an overall length of 133 in., an overall width of 63 in., and an overall height of 76½ in. The crane has a capacity of 6,000 lb at seven ft radius. Literature devotes one page to engineering drawings which give detailed specifications. The facing page details such operating and construction features as: speed, frame, crane unit, boom, drive axle, trail axle, load hoist unit, boom hoist unit, slew unit, steering, plus many others. In addition, application photos show the truck handling various loads. *Elwell-Parker Electric Co.*

For more data circle No. 15 on card

Three Technical Bulletins

Three informative technical bulletins, F-1, F-2 and F-3, are now available. Bulletin F-1 deals with water-dispersing, Phenol-Formaldehyde binder. It discusses the composition and lists many of its advantages as well as baking temperatures and how to handle. Bulletin F-2 deals with water-soluble, Urea-Formaldehyde core binder and lists the composition, advantages and mix variations obtainable. In bulletin F-3 two-stage powdered Phenolic resin for the shell mold process is discussed. Illustrations showing how the shell mold process works are included in the bulletin. *Reichhold Chemicals, Inc.*

For more data circle No. 16 on card

Specifications for Loader

Complete specifications for the Baker-Lull 4B front end loader mounted on various models of R. H. Sheppard industrial type tractors are now available in a two-color catalog sheet. Literature covers the R. H. Sheppard SDI-1, -2 and -3 series and lists materials handling tools available with the shoveloader. A description of the Sheppard fuel injection system is also included. *Baker-Lull Corp.*

For more data circle No. 17 on card

Steel Shot Abrasive

Wheelabrator Steel Shot, a new blast cleaning and peening abrasive, and dust control in metal working, are discussed in two new bulletins now available. The eight-page illustrated booklet on steel shot abrasive includes a discussion of the factors important to the economical and efficient consumption of steel shot abrasive, a photographic comparison of the useful lives of different abrasives, and a discussion on how to perform abrasive tests under actual operating conditions. In the bulletin on dust control particular attention is given to the use of high-efficiency cloth-tube-type dust collectors in the ventilation of grinding and annealing operations, sprue mills, and blast cleaning equipment. A section is also devoted to the role of cloth filtration in such hot operations as the collection of foundry cupola fume and the importance of produce recovery is pointed out. *American Wheelabrator & Equipment Corp.*

For more data circle No. 18 on card

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616 S. Michigan Avenue

Chicago 5, Illinois

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13	14	15	16	17	18

★ Please print or type information below

NAME

TITLE

COMPANY

ADDRESS

CITY AND ZONE

60% longer service life from Nickel iron pots

In addition to producing 80 sizes of melting pots, C. H. MILLES FOUNDRY COMPANY devotes a large portion of its production to metal ingot molds.

A service life of 100 days is good for a plain cast iron melting pot.

But C. H. MILLES FOUNDRY COMPANY of Chicago, Ill., wanted to provide even longer life in the pots they cast.

So they experimented and found that cast iron containing 1.00 to 1.25% nickel would give longer life.

In fact, a typical comparison gave a life span of 160 days for the nickel iron to 100 days for plain iron—an increase of 60%!

Melting pots and ingot molds such as are shown here are typical of the nickel cast iron parts used in elevated temperature applications. At temperatures up to 1300°F. nickel alloyed cast irons maintain a higher proportion of their room temperature strength and hardness, and show less growth and scaling, than unalloyed irons. For applications involving temperatures as high as 1500°F. the austenitic Ni-Resist® compositions are recommended.

At the present time, nickel is available for the production of nickel cast irons and other alloys containing nickel, for end uses in defense and defense supporting industries. The remainder of the supply is available for some civilian applications and governmental stockpiling.

EMBLEM OF INCO SERVICE

AF10-53

The International Nickel Company, Inc.
Dept. 20, 67 Wall Street, New York 5, N. Y.

Please send me booklet entitled, "Guide to the Selection of Engineering Cast Irons."

Name ________ Title ________

Company ________

Address ________

City ________ State ________

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

Molder at Louis Meskan Brass Foundry lifts Edco Dowmetal Bottom Board one-handed.

Notice how its bridge-type construction makes an Edco Board easy to handle, as well as providing resistance to warping and breaking.

"Our EDCO Dowmetal Bottom Boards have paid for themselves in one year...."

says EMMETT TORKELSON, Foundry Superintendent
LOUIS MESKAN BRASS FOUNDRY, INC., CHICAGO, ILLINOIS

"Every one of the 300 Edco Dowmetal Bottom Boards we bought a year ago is still in daily use," says Foundry Superintendent Torkelson. "Further," he says, "our Edco Boards have reduced our scrap loss by helping produce castings true to pattern.

"Edco Dowmetal Bottom Boards are easier to work with. Their design enables the molder to roll the flask with greater ease than is possible with wood boards.

"We figure our Edco Dowmetal Bottom Boards have paid for themselves in one year. This is based on elimination of board repair and replacement, plus scrap savings, since switching from wood boards."

Louis Meskan Brass Foundry, Inc., is a medium-size foundry, casting nonferrous metals, including brass, bronze, copper and lead as well as aluminum.

Whether your foundry is large, medium or small . . . whether you cast iron, steel or nonferrous metals . . . you will find it worth your while to look into Edco Dowmetal Bottom Boards. It's easy to get more information:

Simply write a letter or phone MAnsfield 6-7330 and we'll send you a price schedule and list of 83 standard sizes available from stock.

CHRISTIANSEN CORPORATION

210 SOUTH MARION STREET
OAK PARK 2, ILLINOIS
ALUMINUM ALLOY INGOTS
MAGNESIUM ALLOY INGOTS

Foundrymen in the News

Fred B. Riggan, formerly vice-president, Key Co., East St. Louis, Ill., is now acting as foundry consultant. He will continue in a consulting capacity for the Key organization with whom

F. B. Riggan . . . foundry consultant

he has been connected for 15 years, as well as for Omaha Steel Casting Co., Omaha, Neb., and Standard Brake Shoe Co., Pine Bluff, Ark. He has been active for many years on committees of AFS and the Steel Founders' Society of America.

Raymond A. Frick has been appointed vice-president of the Brake Shoe & Castings Div., of American Brake Shoe Co. Formerly general works manager of the division, he joined the company as a special apprentice in 1942. He has held various operating and administrative positions in several plants of the division and at New York headquarters. Mr. Frick will continue to be located at the company headquarters in New York.

W. D. Sullivan, assistant works manager of the Tubular Products Div. of Babcock & Wilcox Co., Beaver Falls, Pa., has been transferred to the company's boiler division. He will be regional manager of the boiler division, manufacturing department under **M. Nielsen,** vice-president, and will assist in the coordination of manufacturing activities.

J. H. Matthews has been appointed executive vice-president of Raybestos-Manhattan, Inc., at a meeting of the board of directors. He started with the Manhattan Rubber Mfg. Co. in 1914, was appointed assistant factory manager of the Manhattan Rubber Div. in 1940, became director of the company and assistant general manager of the division in 1942. In 1947 Mr. Matthews was elected a vice-president of Raybestos-Manhattan, Inc. He is also vice-president of the Canadian Raybestos Co., Ltd., Peterborough, Ontario, Canada, in charge of the company's Wabash Division at Crawfordsville, Ind., and the new Neenah, Wis. plant, and a director of the Kentucky Synthetic Rubber Corp.

Norton Co., Worcester, Mass., honored its president, **Milton P. Higgins,** with a long-service award, upon his becoming a member of the 25-year group. Along with Mr. Higgins, 906 other long time employees of the company were honored at this traditional ceremony, which dates back to 1921.

Edward George Bartelmas, Waukesha, Wis., has been named foundry superintendent of McKinley Metals, Forth Worth, Texas. He was previously aluminum foreman for the Waukesha Foundry Co., where he had

E. G. Bartelmas . . . superintendent

been employed for 16 years, 12 of these years in an executive capacity. He was general foreman in charge of aluminum for eight years, and has had extensive experience in brass, nickel, aluminum and permanent molding.

Precision Castparts Corp., Portland, Oregon, has announced the appointment of **Don Gjesdahl,** industrial engineer, as district representative for Washington, Idaho, Montana and British Columbia, with offices in Seattle. His activities will be concentrated on the development of new markets for investment casting through the application of advanced design and production methods.

Acheson Colloids Co., Div. of Acheson Industries, Port Huron, Mich., has announced two new appointments to the staff of Acheson's Product Development Laboratory. **James R. Ward** has been appointed research technician. He was formerly employed in the research laboratory of the Diamond Crystal Salt Co. **Walter D. Janssens** has been appointed research assistant. Mr. Janssens came to Acheson from the Marshall Laboratories of E. I. du Pont De Nemours & Co. and had previously worked for Glass Fibers, Inc., and International Minerals & Chemicals Co.

William E. Mahin, former director of research for Armour Foundation of Chicago, has been appointed technical director of Vanadium Corp. of America's new research center in Cambridge, Ohio.

Harold E. Pridmore, formerly with International Molding Machine, La Grange, Ill., is now acting as a foundry analyst in Palo Alto, Calif. He is also agent for Beardsley & Piper Div. of Pettibone-Mulliken Corp. on the west coast.

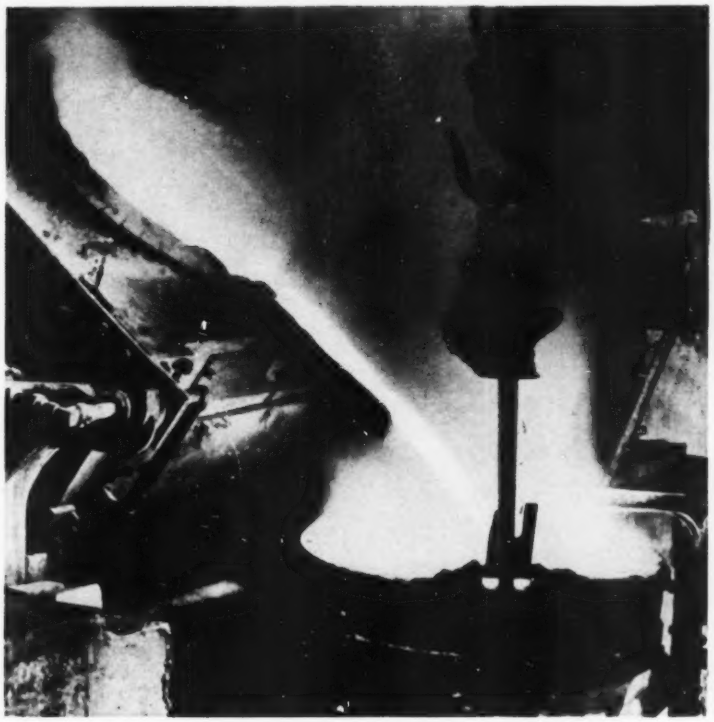
Fred N. Eaton, formerly foundry manager of Bohn Aluminum & Brass Corp., Detroit, is now associated with Howard Foundries, Chicago.

Paul Nesbit has been appointed as a board member of the Cable-Link Corp., Detroit, it was announced recently. In addition to his post in the directorate, he was also elected to the office of treasurer of the corporation, with additional

Paul Nesbit . . . board member

functions as general advisor and executive assistant to the president, **Leo T. Diagle.** Mr. Nesbit has served a number of nationally known firms in executive and managerial capacities.

continued on page 26



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You can handle additions of vanadium conveniently and economically with ELECTROMET ferrovanadium packed in bags.

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	Vanadium	Silicon max.	Carbon max.
High-Speed Grade	50 to 55%	1.50%	0.20%
Special Grade	50 to 55%	2%	0.50%
Open-Hearth Grade	50 to 55%	8%	3%
Foundry Grade	50 to 55%	approx. 10%	3%

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Foundrymen in the News

continued from page 22

Wellman Bronze & Aluminum Co., has announced the appointment of **E. J. Vargo** as assistant production manager for the company. Mr. Vargo was with Wellman Bronze for 11 years, during which time he served as assistant metallurgist, metallurgist and plant superintendent. For the past year he has been employed by Ebaloy Foundries, Rockford, Ill., as works manager. Before joining Wellman, he was in the research department of the Lukens Steel Co., Coatesville, Pa., and also worked for the Timken Roller Bearing Co., Canton, Ohio.

E. J. Vargo . . . Wellman promotion

Sipi Metals Corp., Chicago, has announced the election of officers to newly created executive posts of the company. **Edward M. Pinsof** was elected to the new position of executive vice-president. **Maury E. Lippert,** general sales manager of the company, became vice-president in charge of sales. **Joseph Levin,** superintendent, was elected vice-president in charge of production. **Joseph P. Antonow,** of Antonow & Weissbourd, general counsel of the company was elected a vice-president. **J. D. Rosenblum,** office manager, was elected assistant secretary. **Mrs. Phyllis Pinsof** and **Oscar M. Pinsof** will continue to act in their respective capacities as officers of the company.

Michael Schneider, Chicago, has been awarded an Illinois Institute of Technology scholarship established recently by the American Society for Metals Foundation for Education and Research. The scholarship was established to stimulate increased enrollment of outstanding students in metallurgical curricula. Several scholarships at Illinois Tech are provided by the Foundry Educational Foundation, an organization established by the casting industry in 1947 to improve educational programs in that field.

John Reich has been advanced to factory manager of Hyster Company's Danville, Ill. plant. He was formerly assistant factory manager at the Peoria, Ill. plant and has been with Hyster Co. since 1946 in the capacity of factory engineer, general assembly foreman and supervisor of tool design. Mr. Reich had previously been with Caterpillar Tractor Co., Detroit Engineering Co. and Emerson Electric Co.

John Reich . . . factory manager

Research engineer, **Charles E. Greenlee** has been named assistant to the vice-president of sales at Basic Refractories, Inc. For the past three years, he has specialized in mineralogical studies of dead burned dolomite, dead burned magnesite and other granular-type refractories. In his new position Mr. Greenlee will assist in development projects for new applications of the basic granular refractories being produced at the company's Gabbs, Nevada and Maple Grove, Ohio facilities.

Allan V. DeMarco has been appointed general manager of the foundry division of Hills-McCanna Co., Chicago. Mr. DeMarco was previously in consulting engineering work with the A.R.D. Corp. Prior to that he was general manager of the Exeter Brass Co., Div., Bridgeport Brass Co.

Clayton L. Heintz has been appointed manager of distribution for the Cooper Alloy Foundry Co., Hillside, N. J. He was associated with United Aircraft and later with Dictaphone Corp. For the past five years he has been connected with Ludlow Mfg. and Sales Co. as branch manager.

C. L. Heintz . . . Cooper appointment

Henry M. Clause, formerly engineer for Allis-Chalmers Mfg. Co., Milwaukee, is now associated with Yale & Towne Mfg. Co., Reading, Pa.

Harold E. Simmons is now assistant metallurgist at Air Research Mfg. Co., Los Angeles. He was formerly foundry engineer at Reda Pump Co., Bartlesville, Okla.

H. H. Fairfield, formerly chief metallurgist with William Kennedy and Sons, Owen Sound, Ontario, Canada, has accepted the position of associate professor, Industrial Engineering Department, American University of Beirut, Beirut, Lebanon. Prior to his association with Kennedy, he was foundry consultant for H. W. Dietert Co., Detroit, and before that, research metallurgist for the Bureau of Mines, Ottawa, Canada.

C. E. McQuiston has become associated with the Advance Foundry Co., Dayton, Ohio, as foundry engineer. From 1950 until his employment at Advance, Mr. McQuiston had been an instructor of foundry in the industrial engineering department of the Ohio State University. Prior to this he held various engineering positions with Hamilton Standard Propellers, E. Hartford, Conn., and Wright Patterson Air Force Base, Dayton, Ohio.

Doctor Edward L. Kropa has joined the staff of Battelle Memorial Institute, Columbus, Ohio, as chief chemical consultant. He comes to the research center from the Borden Co., New York City, where he was vice-president and chemical director of the chemical division.

HOW WHEELABRATOR® STEEL SHOT Strikes at Cleaning

LESS ABRASIVE CONSUMPTION

General Heat Treating Co., Syracuse, N. Y. is able to clean 217 lbs. of heat treat work for every pound of Wheelabrator Steel Shot consumed, compared to only 34 lbs. of work cleaned per lb. of malleabilized grit formerly used.

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At a progressive Eastern Steel Foundry the use of Wheelabrator Steel Shot resulted in a 150% increase in blade life with a corresponding increase in the usable life of other machine parts.

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A large New York gray iron foundry slashed abrasive costs from $2.49 per hour to $1.54 . . . a 38% reduction . . . when they switched from chilled iron grit to Wheelabrator Steel Shot.

LESS MAINTENANCE LABOR

Due to the 300% increase in machine parts life resulting from the use of Wheelabrator Steel Shot, maintenance labor costs were slashed at a prominent Eastern plant.

REDUCES SHIPPING, HANDLING AND STORAGE COSTS

American is the only Blast Equipment Manufacturer Producing Steel Shot

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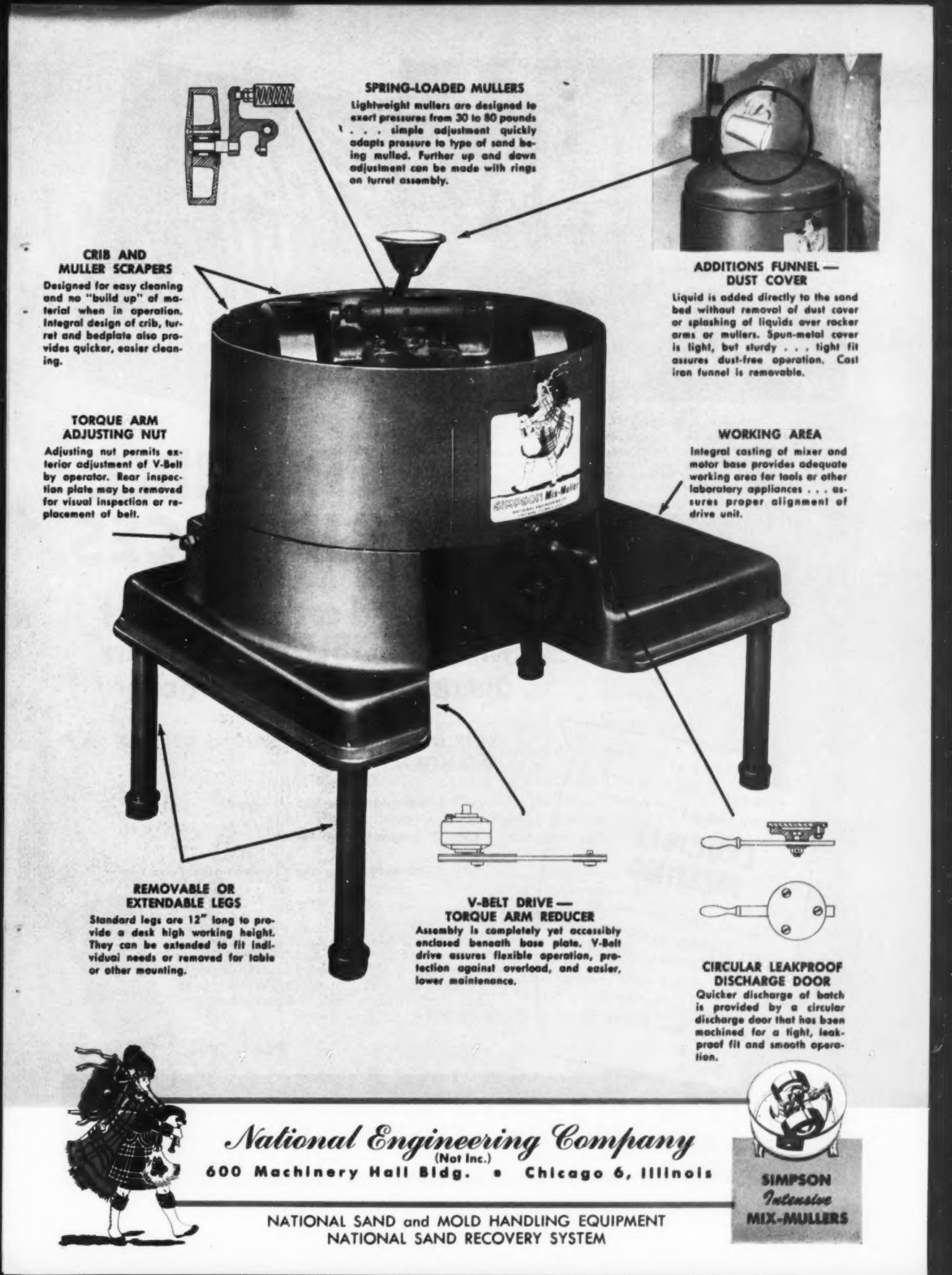
SPRING-LOADED MULLERS
Lightweight mullers are designed to exert pressures from 30 to 80 pounds . . . simple adjustment quickly adapts pressure to type of sand being mulled. Further up and down adjustment can be made with rings on turret assembly.
ADDITIONS FUNNEL — DUST COVER
Liquid is added directly to the sand bed without removal of dust cover or splashing of liquids over rocker arms or mullers. Spun-metal cover is light, but sturdy . . . tight fit assures dust-free operation. Cast iron funnel is removable.
CRIB AND MULLER SCRAPERS
Designed for easy cleaning and no "build up" of material when in operation. Integral design of crib, turret and bedplate also provides quicker, easier cleaning.
TORQUE ARM ADJUSTING NUT
Adjusting nut permits exterior adjustment of V-Belt by operator. Rear inspection plate may be removed for visual inspection or replacement of belt.
WORKING AREA
Integral casting of mixer and motor base provides adequate working area for tools or other laboratory appliances . . . assures proper alignment of drive unit.
SIMPSON Mix-Muller
REMOVABLE OR EXTENDABLE LEGS
Standard legs are 12" long to provide a desk high working height. They can be extended to fit individual needs or removed for table or other mounting.
V-BELT DRIVE — TORQUE ARM REDUCER
Assembly is completely yet accessibly enclosed beneath base plate. V-Belt drive assures flexible operation, protection against overload, and easier, lower maintenance.
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Quicker discharge of batch is provided by a circular discharge door that has been machined for a tight, leakproof fit and smooth operation.
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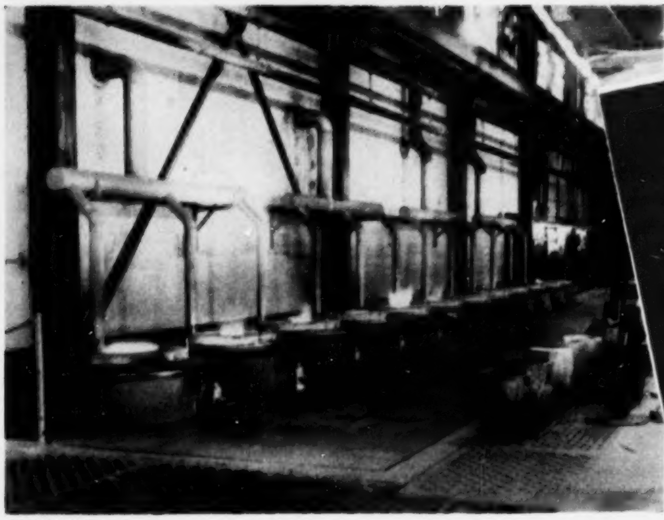

A battery of gas fired, stationary Crucible furnaces at U. S. Naval Gun Factory, Washington, D. C. The pipes manifolded to each set of three furnaces supply air at one pound pressure. Proportional mixers assure constant gas-air ratio set for maximum fuel efficiency and proper furnace atmosphere.

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Metal Quality is best and costs are lowest when CRUCIBLE FURNACES are operated at maximum efficiency

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BEST OPERATING CONDITIONS DEPEND ESSENTIALLY ON—

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Why the Regional Conference?

■ For 32 years, AFS has been sponsoring regional foundry conferences as an integral part of its educational program for the metal castings industry. Few technical societies can show such a record of service for the maximum benefit of members. But what was the purpose of the regional conference, as originally conceived back in 1921 and developed through the years?

The regional conference evolved from the expressed function of the Society to accumulate and disseminate technical information to all branches of its industry. Since the beginning, most of the conferences have been planned with the direct cooperation of universities and colleges, commensurate with the educational aspects of the meetings. In keeping with the regional nature of the conferences, they have been sponsored by local chapters of AFS, which, for geographic or economic reasons, form a logical area grouping.

As an adjunct to the annual AFS Conventions and biennial equipment Exhibits, the regional conference has served to pinpoint foundry problems that are peculiar to certain areas. More than that, they have enabled foundry personnel, other than management, to attend industry meetings that are broader in scope than local chapters can provide. This factor has been particularly important for foremen, supervisors, and technical personnel.

Although regional in scope, participation is usually on a broader basis, with officers and directors from AFS National Headquarters often taking an active part in the technical sessions. Furthermore, the regional conferences are a true belwether of the immediate thinking of the industry. The newest techniques in the foundry field are usually discussed on the program, concurrent with their emergence in castings technology.

The current series of AFS-sponsored regional conferences includes Niagara Frontier, at Buffalo, N. Y.; Ohio, at Cincinnati; Michigan, at East Lansing, Mich.; Northwest, at Seattle; Purdue, at West Lafayette, Ind. Regional conferences are also being planned in February, 1954 for Wisconsin (Milwaukee), and for the Southeastern area, at Chattanooga, Tenn.

Considerable effort, planning, and programming are represented in any one of these conferences. Because of the educational and social benefits that accrue, they are all worthy of the strongest support of all foundrymen.

E C Hoenicke

E. C. HOENICKE
National Director, AFS

One-ton converter in operation.

Photos courtesy Whiting Corp., Harvey, Ill.

Side-Blow Converter Refractories

RALPH A. CLARK/*Asst. Mgr. Development, Electro Metallurgical Div., Union Carbide & Carbon Corp.*

Severe thermal and mechanical service of refractories in the side-blow converter make lining and patching a critical operation in this equipment for producing foundry steel. The article is one of the sections of a forthcoming AFS publication on foundry refractories.

▪ The foundry converter (known as side-blow or Tropenas converter) consists of a pear-shaped steel vessel mounted on trunnions and lined with suitable refractory. A single row of some seven or eight small tuyeres connected with a wind box is located approximately 20 inches above the bottom of the vessel.

In the converter method of producing steel, the primary melting unit is the foundry cupola. This furnace melts a metal charge low in phosphorus and sulphur which may be composed almost entirely of steel scrap, together with a supplementary source of silicon such as lump ferrosilicon or silicon briquets. In some cases, low phosphorus pig iron forms a portion of the cupola charge. Cupola metal may analyze approximately 3.00 per cent carbon, 1.75 per cent silicon, 0.50 per cent manganese, 0.05 per cent max. phosphorus and, possibly, 0.10 per cent sulphur. This metal is tapped into a ladle to which has been added fused soda ash or caustic soda in sufficient amount to reduce the sulphur content of the iron to 0.05 per cent max. When enough cupola metal for a converter charge has been accumulated, the ladle is removed from under the cupola spout, the spent desulphurizing slag skimmed from the molten metal, and the desulphurized iron poured into the preheated converter vessel.

The converter is unfired in the usual sense. Capacity may vary between 1000 lb and 6 tons when filled with molten iron to the tuyere level. Air introduced through the tuyeres at a pressure of 2 to 4 psi causes agitation of the molten change and oxidizes the silicon, manganese, and carbon in the order named. Oxidation of these elements provides sufficient heat to increase the

TABLE NO. 1—TYPICAL SIDE-BLOW CONVERTER LINING MATERIALS

Foundry	1	2	3	4	5
Capacity of Vessel	2 ton	2 ton	3½ ton	1,000 lb	3 ton
	Silica Brick	Monolithic	Monolithic	Monolithic	Monolithic
Body	Laid with 4½" dimension, perpendicular to inside surface	1900 lb South Dakota Ganister, ¼" x D. 143 lb Bentonite 173 lb Fireclay 400 lb Silica Flour Water to ramming consistency	900 lb Pennsylvania Ganister 100 lb Graphite, 30 Mesh 50 lb Plastic Fireclay 30 lb Bentonite Water to ramming consistency	50% ⅜" x D Western Ganister 30% ⅛" x D Western Ganister 14% Silica Flour 6% Bentonite 7% Minimum water by weight	80% ¼" x D Eastern Ganister 20% Plastic Fireclay Moistened to ramming consistency with 10% Molasses Water
	Monolithic	Monolithic	Monolithic	Monolithic	Monolithic
Nose	Mica Schist thru ½" on ⅛" 3% Fireclay Water to very dry ramming consistency	As Above	As Above	As Above	As Above
Tuyeres	Preformed silica tuyere blocks	Rammed	Rammed	Rammed	Rammed
Bottom	Silica Brick	Monolithic	Silica Brick	Monolithic	Silica Brick
Maintenance	Patched with Silica Brick each 3 days or about 18 blows				

temperature several hundred degrees, say from 2400 to possibly 3100 F. Control of the blowing cycle is accomplished by observation of the flame and blowing is completed when the carbon flame drops or diminishes in volume and intensity, at which time the vessel is turned down and the air blast shut off. Blown metal at this stage will analyze approximately 0.08 per cent carbon, 0.08 per cent manganese, and 0.05 per cent silicon.

Recarburizing to the desired degree is accomplished by adding the necessary weight of molten cupola metal followed by preliminary deoxidation with ferromanganese or silicomanganese. The vessel is then tapped into a preheated ladle to which is added sufficient 50 per cent ferrosilicon to yield the desired silicon content. Final deoxidation may be accomplished by plunging into the ladle some 2 lb of aluminum per ton. This may be in the form of stars or pig aluminum wired to a steel rod.

Produces Good Metal

The converter process, properly controlled, yields steel of excellent mechanical properties and of sufficient temperature and fluidity to pour castings of very light section. However, the converter has fallen into some disfavor during the past 20 or 30 years because of the cost of rather high metal losses and the fact that, on occasion, there has been some difficulty in obtaining precise control of metal composition and temperature. The cupola-converter process does have the advantage of producing high tonnages of molten steel suitable for casting with a minimum investment for melting equipment. The converter was employed in several triplex steel melting installations during the last war (cupola-converter-electric furnace) which supplied large tonnages of continuous metal for high production steel foundry units.

This article was written largely in view of these applications of the side-blow converter and new developments which it appears may widen the field of application of one of the oldest methods of producing foundry steel.

Brief consideration of the converter process will convince one that here is a severe application for acid refractories. In this one unit are found conditions of severe heat shock conducive to spalling, extremely high temperature, scouring high iron oxide slag, severe metal erosion, and gas or flame erosion. Foundry converters have been lined with a variety of acid or silica base refractories, including silica brick, firestone, mica-schist, and rammed silica ganister mixes bonded with fireclay. Present-day linings may be built from silica brick, but more frequently are of rammed monolithic materials.

Ramming materials vary widely, but usually consist of a suitably sized silica ganister bonded with plastic fireclay or other types of clay. Sometimes an organic binder such as molasses is added to form a dry bond before firing and to improve the ramming properties. The mixtures given in Table 1 have been reported by various converter foundries.

Ganister Ramming Mixtures

Formulation of a successful ramming mixture involves many considerations. Highest refractoriness will usually be obtained at the highest possible silica content. Also, the material must be so sized as to allow ramming to high density without leaving voids which would affect the solidity of the lining. In considering various ganisters, it should be borne in mind that the

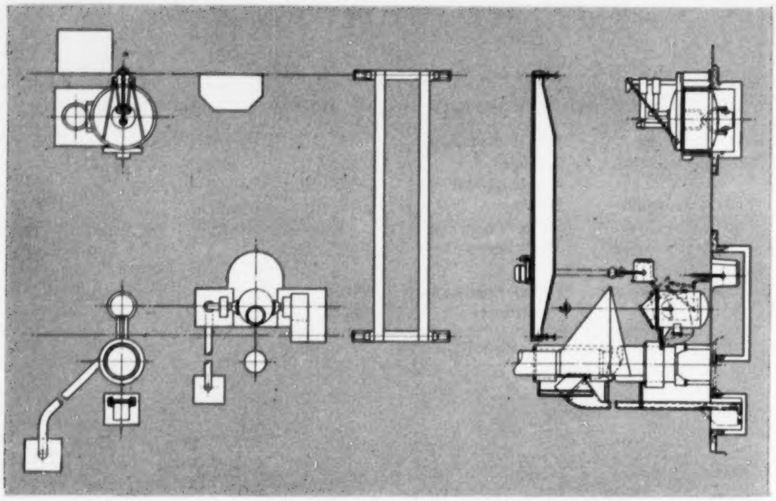


Fig. 2—Triplexing arrangement for steel production.

eastern deposits such as those in the vicinity of Mt. Union, Pa., are much more friable than material from the South Dakota or Wisconsin areas.

For this reason, a given size grading, for instance ¼ in x D (¼-in. and down), will contain a high proportion of fine material in eastern ganisters, but the same size from one of the western deposits will break up less in crushing and contain a much higher proportion of granular material with a minimum of fines. Such ganisters may require the addition of silica flour or ganister of finer grade for the purpose of providing sufficient fine material to fill in around the coarse particles and provide a mixture which can be rammed to maximum density.

Lower Fusion Point

Any of the clays used as bonding agents will lower the fusion point of the mixture to a point lower than that of the silica ganister alone. Although it is generally recognized that good quality plastic fireclays are more refractory than the western bentonites, the bentonites are much more plastic. Thus considerably smaller amounts may be used to provide the necessary binding strength. In such cases, the use of bonding material of lower refractoriness may actually result in a higher degree of refractoriness of the lining due to the smaller proportion of bond required. Bentonite is valuable in that it provides high dry and hot strength in the unfired condition which exists before use and behind the vitrified surface after the converter has been placed in use.

As in foundry sands, a combination of bentonite and fireclay will provide a somewhat higher hot strength than either bond used alone, and this probably explains the use of a combination of the two materials in some of the mixtures (Table 1).

It is difficult to suggest a proper moisture level in the ramming mixture. The water content must be high enough to develop the plasticity of the clay, but not so high as to cause puffing or creeping during the ramming operation. The optimum percentage will vary widely, depending upon the amount and type of clay in the mixture and the percentage of fine material in the ganister portion.

Mixtures low in clay will ram densely, but are subject to spalling during preheating and deficient in strength. On the other hand, mixtures too high in clay are difficult to ram to uniform density and are less refractory than those containing a higher proportion of silica ganister.

Ganister mixtures must be thoroughly mixed in a sand muller or similar type of mixer to assure proper distribution of the bonding agent and to develop the plasticity of the clay bond.

Figure 3 illustrates a 2-ton converter that has been lined with silica brick. Note that a rammed ganister mixture is provided against the shell to form a cushion behind the silica brick lining. The details of laying the brick are clearly illustrated. It will be noted that the converter shell is fabricated in two pieces, a cylindrical body section and the removable nose in the shape of a truncated cone. In this case, the nose piece is rammed with a clay ganister mixture.

In lining the vessel, the nose portion is removed and a ganister lining rammed in place around a tapered form constructed of steel plate or wood. In the meantime, the brick lining is placed in the body section as illustrated. In this case, the tuyeres are formed in a special silica tile so that they can be placed as a unit. After lining, the joint is sealed with soft fireclay mud, the nose is placed on the lined body and secured in place.

Monolithic Linings More Common

The dimensions shown in Fig. 3 are similar to those used for rammed ganister linings which are more frequently employed. Ganister linings are formed by ramming a suitable mixture around a steel or wooden form which is gradually lifted as the lining progresses upward. The first step in preparing such a lining is the preparation of the bottom. In many cases, clay ganister mixture is rammed into the rounded vessel bottom to give a flat foundation, covered by two layers of silica brick to form a solid and flat refractory bottom for the vessel. The silica brick bottoms may be laid with a suitable cement or, in some cases, the brick are placed dry and fine silica sand brushed into the crevices between them. As an alternate practice, the entire bottom

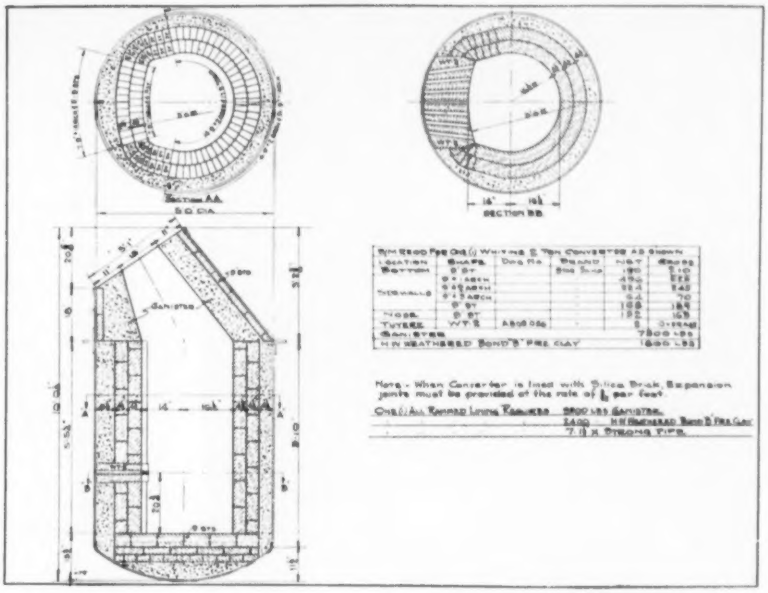


Fig. 3—Lining and count for two-ton converter.

may be formed of clay ganister mixture which is rammed solidly in place. However, to yield the best service, monolithic linings should be rammed in layers perpendicular to the heated surface. It is obviously impossible to accomplish this in the bottom of the vessel and, for this reason, the brick bottom is probably the most practical.

After the bottom is properly placed, a steel or wooden form fabricated to the desired shape is placed in position and centered in the unlined shell. This form must be solidly made. It is about 2 ft in depth and should have sufficient taper to be easily lifted as lining progresses. Obviously, it can have no projections on the sides which would prevent drawing it out of the rammed lining. After placing the form in position, ramming material is placed in a thin layer between the form and outer shell and solidly compacted using a compressed air rammer. The tool used has a flat surface 2½ to 3 in. in diameter.

Bottom Material Softer

It is most important to have the layers of material thin and rammed just as solidly as possible. The surface of each layer is roughened after ramming to make a good bond with the next layer. In no case should the rammed layer of refractory be thicker than 1 to 2 in., and the thinner the better. Material at the bottom of each layer will be softer than at the upper surface, and observations of burnt linings will reveal a wavy or rippled surface with the high points corresponding to the location of the top of each layer where ramming is most dense. Ramming in very thin layers is laborious and time consuming, but pays big dividends in increased lining life.

When the lining reaches the tuyere level, the surface of the ganister may be leveled off and silica brick tuyere segments inserted, or more commonly the tuyeres may be formed in the monolithic lining material. In the latter case, steel pipe of a suitable diameter are held in place by a wooden block which is located by clamping in the wind box. These pipe are used as forms for the tuyere openings. They must be bedded carefully into the rammed material and every precaution taken to assure that the tuyere openings are level and solidly rammed. Ramming must be particularly firm in this location, which is exposed to more severe wear than any other portion of the converter lining.

After placing of the tuyeres, ramming continues in the same manner until the sidewalls are completed, the form being lifted as necessary by a crane or overhead hoist as the ramming progresses.

Need Dense Nose Piece Lining

In the meanwhile, the nose piece is placed small end down on a flat floor and a suitable tapered form secured inside. The clay-ganister mixture used as the lining is rammed inside in the same manner as in the body of the converter. Careful ramming to a consistently high density is particularly important in this portion of the lining.

In converters large enough to allow entry of a man through the nose opening, the lining is often stopped some 4 in. below the joint of both the body and nose piece. The nose is then placed on the shell and secured by suitable eye bolts. The shell is then turned on its side, and a man enters the vessel through the nose opening. Ganister mixture is rammed into the joint between the two portions of the vessel, using a small air rammer. This assures a solid and tight joint, but is impractical in very small vessels. In such a case, the lining of both the nosepiece and body are continued to the flange level and scraped off flat. A layer of soft fireclay mud is placed on top of the refractory lining of the body and the nose piece placed and secured. The soft clay fills the irregularities and assures a metal-tight joint between the body and nose.

Both monolithic linings and those formed of silica brick require slow and thorough drying followed by carefully preheating to dull red heat before being

Fig. 4—Another view of one-ton converter.

placed in service. Indirect heaters that blow air at a temperature of 500 to 600 F through the newly lined vessel for a period of 24 to 48 hours, have been especially successful. Initial drying is sometimes accomplished by a slow wood fire followed by a charcoal or coke fire for prolonged periods. It must be emphasized that there is a large amount of water contained in a new lining. If properly rammed, the lining is dense and to avoid damage, drying must be gradual and prolonged.

After the lined converter is thoroughly dried, it can be gradually brought to dull red heat at the inside surface over a period of several hours, using a gas or oil torch adjusted for a soft, lazy flame. This operation will complete the drying and drive off a portion of the combined water in the clay bond. Again a charcoal or coke fire is sometimes used for preheating. Before the converter receives its first charge of metal, the lining should be heated to as high a temperature as possible, either by the use of the charcoal fire with an air blast, or by some other method.

One practical method consists of providing fuel oil under pressure, which is introduced into the lined vessel by placing a 1/4-in. pipe through a hole drilled in the wind box cover in line with one of the tuyere openings. Oil under high pressure is piped into the converter through a 1/4-in. pipe, the blower turned on and the oil ignited, making a huge oil torch out of the entire vessel. With proper adjustment of the oil supply and the air blast, the converter can be preheated to a white heat in approximately an hour.

Careful and prolonged drying, followed by thorough preheating will do much to avoid serious spalling during or prior to the first blow. Also, preheating to a high temperature before introduction of metal for the

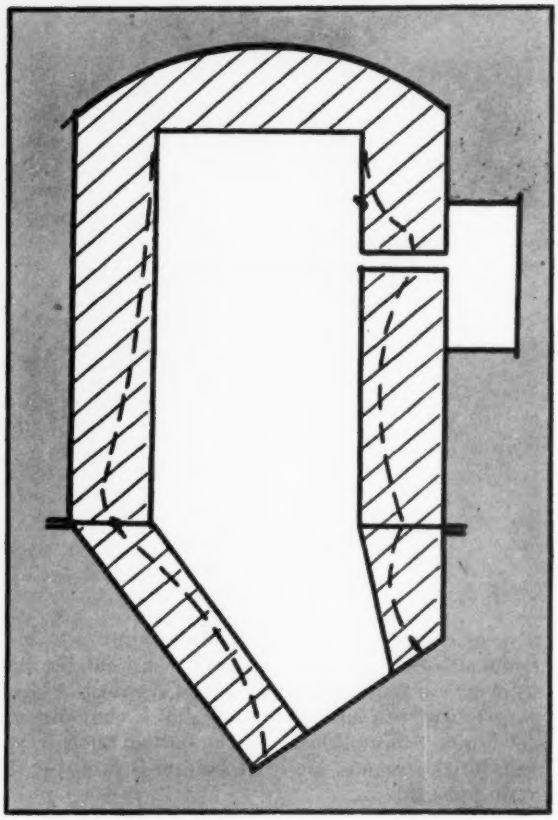


Fig. 5—Areas of greatest wear of converter lining.

first blow will insure improved blowing conditions and a fast, hot, and quiet blow. A cold or poorly dried lining means spalling, a violent and prolonged blow, and the production of a heat of steel which is too cold for proper use.

Blowing Rate and Metal Composition

The refractory of the side-blow converter is subject to severe service conditions, involving spalling on initial use and the first blow of each day's campaign, as well as very high temperature, scouring from high iron oxide slag, and severe erosion by both metal and slag. Satisfactory lining life depends on the selection of a good ramming mixture, its careful mixing, dense ramming, and proper drying and preheating. Many other factors will also influence the life of a given lining. These include the composition and temperature of the cupola metal, the length and frequency of individual blows, the temperature at which the blown metal is tapped, the condition of the tuyeres, the introduction of desulphurizing slag and the following other factors:

1. The duration of an individual blow is determined by the temperature of the cupola metal and the converter lining, as well as the composition of the cupola metal. The silicon, manganese, and carbon form the fuel for the converter process. Obviously, the higher the percentage of these elements in the iron charge, the longer it will take to eliminate them and the greater will be the temperature attained by the metal and the interior face of the refractory.

As converter metal is often tapped at temperatures well above the fusion point of the lining, an unduly prolonged blow will do serious damage to the refractories. Metal to be used in the triplex process which feeds an electric furnace, can be tapped at considerably lower temperature than when castings are poured directly from converter steel. In such cases, lower silicon iron can be used, and the time of the blow and maximum temperature of the metal will be reduced with consequent benefit to refractory life. Cupola metal in the range of 0.75 per cent silicon has been blown successfully under such conditions.

2. Consistently high temperature cupola metal tends to make for fast, uniform blowing with a minimum of agitation. If the temperature can be depended upon to be uniformly high, the silicon content can be somewhat reduced, a factor which in itself helps to reduce blowing time. Cold iron, on the other hand, means ragged blowing, excessive boiling and much spitting of slag and metal—conditions which contribute to rapid lining failure, particularly in the nose section of the vessel.

3. Careful skimming of the alkaline desulphurizing slag from the cupola metal is essential. Any of this slag introduced into the converter will flux the acid lining severely.

4. The amount of cupola metal charged should be carefully gauged to allow a blowing angle of 6 to 8 degrees from the vertical when the vessel is turned back to the point where the metal level is just at the lower edge of the tuyeres. In this position, the tuyeres will be some 6 to 8 degrees from the horizontal. It is important that the tuyeres be installed in a straight line so located that their mouths will all be in line with the metal level. Careless installation may result in several of them being considerably above the level of others. Also, unless the trunnion stands are perfectly level, the tuyeres at one end of the row may be higher than at the other, even when carefully rammed. Such conditions slow up the progress of the converter blow.

May Result in Erosion

Poorly rammed tuyeres may result in the erosion of refractories, and in poor blowing conditions which are damaging to lining life. Careful attention to such details as accurate location and dense ramming of the tuyeres and control of the blowing angle, helps in obtaining clean and rapid blowing with minimum damage to the refractory.

5. At the completion of a converter blow, the lining surface is soft and near its fusion point. If it can be allowed to cool for some minutes before the following blow, the lining will harden somewhat and better life can be anticipated than when another charge is at once introduced into the hot converter. For this reason, when the equipment is available, it may be economical to operate two vessels on alternate blows, even though one of them could readily take care of the demand for metal. In this case, better refractory life must be balanced against the need for somewhat higher silicon in the cupola metal.

6. Overblowing can be a factor in lining life, as well as in the quality of the steel produced. After the end point (indicated by drop of the carbon flame) has been reached further blowing results in a rapid buildup of the iron oxide content of the slag.

Fig. 6—Master electric eye instrument in use.

Repair of Converter Linings

Certain locations in the converter are subjected to particularly severe conditions. These locations (Fig. 5) are at the mouth and particularly in the wall at the inner ends of the tuyeres and above the tuyeres. If used for only a few blows at a time, it is well to resort to patching in order to maintain the inside dimensions of the lining. With judicious patching, as many as 200 to 300 blows have been reported from individual linings. If necessary, the nose can be removed when badly eroded and a new one placed on the used body section.

In triplex practice, converters are usually used continuously until the lining is eroded to a point where the size of the blow increases enough to be unwieldly or dangerous. In one case, a range of 7000 lb to some 9000 lb has been considered normal. When a lining that contained 7000 lb of metal at the beginning of a campaign was eroded to the point where blows were averaging 9500 lb, the vessel was removed from the stands and a freshly lined one substituted. After cooling, the vitrified surface was chipped from the remaining lining, and a new lining rammed in and dried, making the vessel ready for another campaign.

New developments indicate that changes in the contour of the normal foundry-type side-blow converter may have a beneficial effect on the life of the refractory. Also, work has been done using a basic lining under laboratory and steel mill conditions. To date, there has been little or no commercial application of these ideas, but it is possible that such modifications, together with the possible use of oxygen enriched blast, may return the side-blow converter into more general acceptance at some time in the future.


Chairman R. J. Teetor


H. S. Simpson


W. L. Woody

Plans Completed For AFS Foundry Technical

WITH COMPLETION of detailed drawings and specifications for construction of the permanent AFS Headquarters Building in Des Plaines, Ill., a general contractor soon will be selected on bids and actual construction begun during October.

The new headquarters will represent the culmination of the efforts of many men prominent in the foundry industry, who have long visualized a Foundry Technical Center that would be a credit to a primary industry of such importance to our economy. More specifically, it will serve as the National Headquarters of AFS, provide adequate quarters of functional design for the many activities of the Society, and reduce the continually rising rental costs.

Functional Design

When completed in August, 1954, the building will reflect the modern design techniques that are being incorporated by Mr. Riecks and the architect, Charles W. Nicol & Associates, Chicago, with Giffels & Vallet, Detroit, as associate architect and engineers.

The building will be constructed of reinforced brick and concrete, and will be completely fireproof. Wherever possible, materials have been selected so as to minimize operating and maintenance costs. The sash, of extruded aluminum, will require no painting. Copper has been specified wherever corrosion is likely. Ceilings will be of acoustical materials, with recessed tubular lighting and air diffusers. Other features include: rubber tile floor covering, thermopane windows, doorless private offices, and oil-fired heating plant.

Unimpeded, due-north lighting will be utilized for natural illumination in a building that will have 10,500 sq ft of floor space on one level. In addition to general offices, the structure will include a combined library and conference room; a large stockroom; facilities for reproduction, addressing and mailing; semi-departmentalization of activities; and a small lunchroom. All units except the stockroom will be air-conditioned all year, and heated in winter by both forced hot-water radiant heat and circulating warm air. The plans allow adequate space for future expansion of the building, should that become necessary.

Although the idea for a new, AFS-owned Foundry Technical Center was conceived some years ago, the first campaign to implement the program began in 1950. Charged with the responsibility of securing the money necessary to build the headquarters, the AFS Building Committee raised a total of $148,000 in

F. C. Riecks

W. B. Wallis

G. H. Clamer

Members of AFS Building Committee

Erection of Center

voluntary contributions in approximately two years. This gratifying response demonstrated the faith of over 850 firms, AFS Chapters, and individual members in the project. A total of 127 contributors gave sums between $250 and $1000. Fifty contributions totalled $1000 each or more.

Since then, however, spiralling prices of materials and labor have forced the estimated cost of completion for the project up to approximately $250,000. The Board of Directors has authorized a special solicitation to raise the additional $100,000 during the remainder of 1953, in order to finance the increased costs. This appeal will not be a general solicitation of the entire membership of AFS. In any event, the structure will be completed and ready for occupancy prior to expiration of present office lease.

A permanent record will be kept in the new building of all Charter Subscribers, a list that will comprise all contributors to the present and the earlier solicitations. The names will be either engraved on a suitable plaque, or engrossed in a properly bound volume.

American Foundrymen's Society must keep faith with its 11,000 members in all parts of the world and its 56 local and student Chapters in the United States, Canada, and Mexico. The Society is pledged to build one of the finest headquarters and technical centers available to any industry.

To carry out these purposes, AFS must have a properly equipped headquarters to facilitate its expanded research program, organize a vigorous educational service, and step-up its safety, hygiene and air pollution activities. The Society must keep pace with the constantly progressing needs of an industry that is fundamental to our culture, one that has contributed so vastly to civilization as we know it.

The project is under the supervision of the AFS Building Committee, with R. J. Teetor as Chairman, and including F. C. Riecks, owner representative in charge; G. H. Clamer; H. S. Simpson; W. B. Wallis; and Walton L. Woody. William N. Davis of AFS National Headquarters is functioning as Staff Liaison officer for the project.

Two-thirds Raised

Approximately two-thirds of the required contractual cost of the new headquarters building has been contributed through the generosity of AFS members. The Building Committee has received a vote of confidence from the AFS Board and authority to complete the project in a manner commensurate with its purpose.

Individual and Company members are asked to assist in raising the additional $100,000 that is now needed to carry out the planning of the Building Committee. The permanent National Headquarters of American Foundrymen's Society will be a tribute to the far-sightedness of your industry leaders, and will form a Foundry Technical Center that will constitute the hub of technological activities for all phases of metals casting. An investment in the AFS Building Fund will help furnish the working tools to finish a job that should *and will be* BUILT BY EVERY MEMBER!!

Evaluating Molding Methods
Part II

The Place of Shell Molding

J. B. Stazinski/*Manager, Everett & Lynn Foundaries General Electric Co.*

Based on presentations made at a Sand Shop Course session of the 1953 AFS Convention at Chicago, this article is the second and final section of a series reviewing molding methods. Featured here are shell molds, permanent molds and die casting, and core molds.

■ Don't sell your sand casting foundry! However, don't try to ignore this newcomer to the foundry industry—shell molding. It has a place as a method for making some types of castings. Where it fits, it excels other methods. More important, it promises to bring into the foundry industry as castings many parts which are not now cast. Thus, it will add to and not subtract from the business the industry may obtain.

Look for shell molded casting applications in two broad areas. The first area, and the one in which to concentrate most, is on those parts which are not now castings. These are the parts made from forgings and bar stock which require much more machining than castings, and the heavy stampings or fabrications. Many of these parts have fairly intricate contours and are made by other methods because conventional sand castings have not afforded the design engineer the necessary exacting dimensional accuracy, surface quality, and design flexibility. These include somewhat thinner wall metal sections, small and intricate cast holes, and pockets, sharp-detail, minimum draft, etc. Investment castings may not have been competitive in cost or may have involved excessive tooling for the applications.

The second area is the application of shell to the castings which we are now making by conventional methods such as green sand, dry sand, cores, and permanent mold. This requires careful weighing of economics.

Advantages

Based on our experience, there appear to be several advantages in shell molding over conventional molding methods:

1. Tolerances can be held closer than conventional methods but not as close as the small investment castings. In some cases, we have held dimensions to 0.002 in. per in. In other cases, we are unable to hold any closer than 0.007 to 0.010 in. per in. The degree of precision appears to depend on the shape, contours of mold, and the type of metal being poured.

2. Less draft is required than for sand molding. In many cases, parts of the pattern will draw with no draft at all.

3. Castings can be poured with thinner wall sections and with metal at lower temperatures than would be possible in green sand. This appears to be due to the fact that the shell molded castings cool the metal more slowly due to the insulating effect of the shell. Also, the higher permeability of the shell promotes free venting of gases.

4. Small cored holes, intricate pockets and sharp contours which would be impractical in other methods are frequently possible in shell molding. Holes 1/4 in. in diameter and 1/2 in. deep have been quite accurately cast.

5. Much smoother surfaces can be obtained, because

it is possible to use a very fine sand. A marked improvement is noticeable with the higher melting temperature metals.

Cost Factors—Favorable and Unfavorable

These advantages will, in many ways, permit the customer to make money saving eliminations in rough machining operations. It will also give him a lighter weight casting with superior appearance. Thus, a shell molded casting can sell for a higher price than its counterpart produced by the conventional method and still be economical for the customer to use.

There is considerable debate about the potential relative cost of shell molded castings versus conventional sand castings. It is believed that no generalization is possible since the relative costs of the two methods will vary according to the particular requirements of individual parts. Several factors tend to make shell molding more costly. On the other hand, several other factors tend to offset or overcome this cost disadvantage. Development of improved methods and equipment will undoubtedly continue to reduce shell molding costs. Here are the unfavorable cost factors:—

1. The resin is considerably more costly than any of the bonding additions used in conventional sand mixes. The chemical people are doing a job of trying to reduce this cost as their production requirements increase, and they too improve their methods.

2. Clamping and backing-up the shell molds is costly. The efficient handling of shot or grit is a tough problem to date—at least in our own foundries and those we have visited. However, techniques for stitching or quick clamping and back-up of shell molds look promising. In fact, we have found, that in some cases, we can pour with no backing.

3. Patterns are relatively costly. We have found that iron patterns are required for production runs. Aluminum patterns are satisfactorily for development and for producing small quantities but tend to score and become rough with continued use.

The Advantages

On the favorable side, however, there are these cost advantages:—

1. The shells for this operation can be made at considerably lower cost than making a comparable sand mold. Several manufacturers have developed machines that will produce shells at very high rates—from 60 per hour and up, depending on the number of stations and men required to operate.

2. Floor space requirements are considerably lower than for comparable sand casting facilities. Hence, the capital investment is lower. Heat, light, and other elements of indirect cost are lower.

3. Scrap losses should be low since the foundryman's chief bugaboo—moisture—is entirely eliminated as a factor in shell molding. Shell molds are completely free from moisture. Hence, no steam comes into contact with the metal.

4. Casting weight can be reduced through thinner metal sections and elimination of rough machine finish allowances. This saves metal cost and reduces handling costs and shipping charges. Another interesting advantage is that the weights of the castings are very consistent and in our experience, are always lighter than conventional methods.

Fig. 1—Part made of 310 stainless steel. When made as sand casting, required 28 hours hand grinding, plus machining. As shell molded casting, cost dropped to only one-quarter that of investment casting.

Fig. 2—This part, of 4140 steel, was originally a forging. When cast with shell molding, 67 per cent with extremely accurate dimensional tolerances.

5. Shell molding takes out much of the physical labor that is associated with the conventional molding, thereby affording a means of attracting people to work in foundries. The shell being light and relatively clean as compared to a sand mold really can change working conditions, and makes this type of foundry a better place to work. This factor alone will have an effect on the availability of people and the rates paid per hour.

Here are some castings that we have made in our foundries and our experience with each:

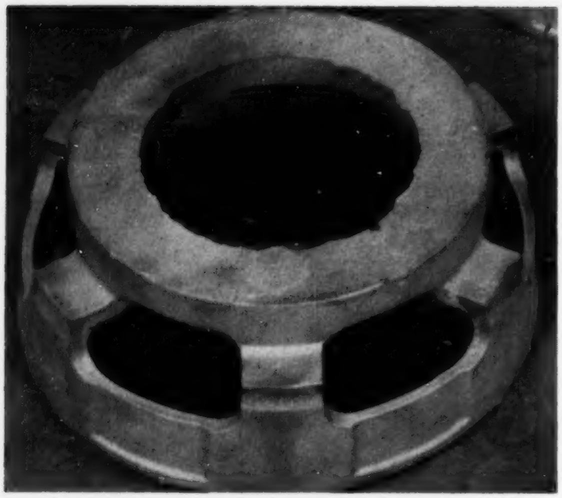


Fig. 3—Made of 410 stainless steel, this part was also formerly an investment casting. Shell molding cut production costs by 70 per cent.

Fig. 4—About 30 per cent saving weight resulted when this gray iron casting was converted to shell molding. Elimination of machining is one advantage here.

Figure 1 is a part made of 310 stainless steel (25 Cr, 20 Ni) material. At one time, it had been made as a sand casting. However, it required 28 hours of hand grinding plus extensive machining. The finished cost was so great, that it was then converted to an investment process. The casting cost was considerably higher, but the ultimate finished cost was lower than that of the sand cast part. As a shell molded casting, the cost is only 1/4 that of the investment casting. Dimensional tolerances—to our own surprise—proved better than the investment casting and the surface finish was almost as good.

The part in Fig. 2 is made in 4140 steel (1 Cr, 25 Mo, 0.40 C). This part was originally a forging. As a shell molded casting, machining was reduced over 67 per cent. Dimensional tolerances are held to 0.008 in. on the 3-1/4-in. diameter.

Another casting was made of 1005 steel (0.05 carbon with 0.5 aluminum)—quite a difficult metal to cast. However, we are having fairly good success in running this in shell molds. Formerly, the part had been machined out of solid Armco iron or from a forging of the same material. Dimensions are being held to plus or minus 0.015 in. across the parting line and plus or minus 0.005 in. on the diameters. We have not yet determined whether there will be a cost saving on the completed part since the machining operations which we have been able to eliminate are fairly simple and of low cost.

Figure 3 illustrates a part of 410 stainless steel (12 Cr) that was formerly produced as an investment casting. The shell casting costs 70 per cent less to produce. Dimensions are actually held closer on the shell casting than the investment casting. Concentricity is held to 0.005 compared with 0.020.

Regular gray iron is used in the casting shown in Fig. 4. Elimination of machining on the 2.25 in. diameter is on of the advantages here. These are cast close enough to allow a press fit of a component part. There has been a reduction of 30 per cent in weight.

The part in Fig. 5 is a high strength gray iron and was formerly cast in permanent mold to guarantee good close metal in the teeth. The teeth are cast with such good detail and accuracy that only a final hobbing operation is necessary. There has also been a reduction in weight here of approximately 20 per cent.

Another high strength gray iron part made in a permanent mold is shown in Fig. 6. The customer has eliminated on this small casting four complete machining operations and the weight of the casting has been reduced 30 per cent.

In Fig. 7, the material is regular gray iron. Work is progressing on this part to eliminate all machining except for the tapping of four holes.

A comparatively complex shell mold is shown in

Fig. 5—This part was formerly cast in permanent mold to guarantee close metal in teeth. Shell molding has provided good detail and accuracy, with weight reduction.

Fig. 8 to illustrate the ease with which mold sections can be made to fit together.

Don't neglect shell molding as a casting method where these conditions exist:

1. Possibility of eliminating some machining operations.

2. Need for thinner sections, small cored holes, sharp contours, minimum draft, or intricate pockets in the casting design.

3. Weight reduction.

4. Need for surface appearance better than you can obtain in conventional sand practice.

Fig. 6—Elimination of four complete machining operations and 30 per cent reduction in weight resulted when this gray iron part was cast in shell molding.

Molding in Core Sand

GEORGE P. ANTONIC/*Superintendent, Motor Castings Co., Milwaukee*

■ The selection of molding in an all core sand medium in most instances is dictated by the casting design. Some castings can thus be made only in core sand such as air-cooled cylinders, octane testers where the metal sections must be held to within 1/64 of an inch, and the like.

It is generally accepted that castings made in core sand have finer finish, much better dimensional stability, and truer pattern reproduction. Should the purchaser require close tolerance and exceptionally fine finish it can be obtained in core sand. Short run jobs may also be made economically by this method. In some instances the cost of new flask equipment cannot be justified for just a few castings.

A much overlooked benefit derived from core sand molding relates to metal shrinkage. This is especially important in castings subject to hydraulic pressure in their ultimate use. Molding in cores permits a far greater flexibility in gating and risering than in any other form of molding. In gray iron, gating through a thin section of a casting reduces the amount of risering required by promoting a more uniform heat gradient. It is possible to take advantage of this because, after assembly, the mold can be turned into any position for pouring.

The use of risers is greatly reduced or eliminated. Because of the mold wall stability, far less feed metal is required to take care of shrinkage due to mold wall movement. The freezing of iron with 1.75 per cent free carbon requires very little feed metal. In green sand practice, where the mold cavity shows continued expansion over a period of time, relatively large risers are required to supply feed metal over this period of

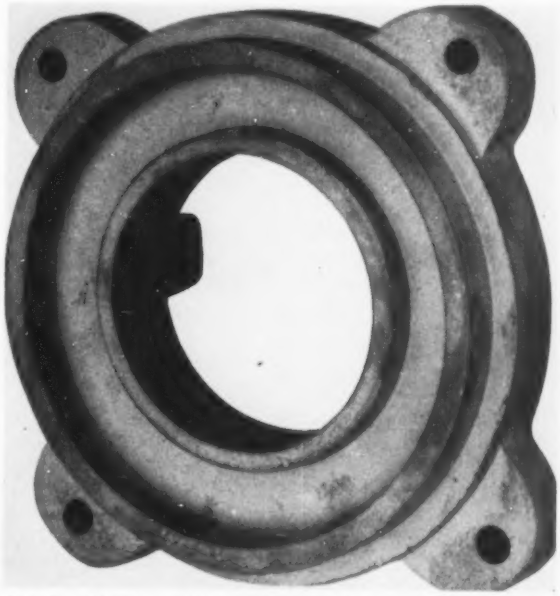


Fig. 7—Working with regular gray iron, progress is being made on this part to eliminate all machining except for the tapping of four holes in outer lugs.

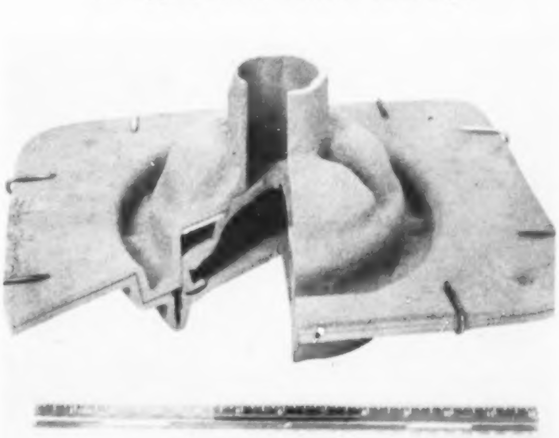


Fig. 8—This photo illustrates a comparatively complex shell mold to demonstrate the ease with which mold sections can be made to fit together.

time. In sand practice where the mold growth is large but over a short period of time, smaller risers are used to supply feed metal. However in practically all instances cores show a dilation of 1/10 to 1/15 that of green sand and therefore in many instances require no risers at all. This permits the production of some castings that are practically impossible to riser by nature of their design.

These are but a few of the benefits obtained from this method of molding. Its application in any shop must be weighed to determine whether or not the added cost is justified. Shipping castings out the back door only to have them returned is certainly not profitable. Especially so if some of the advantages of core sand molds can eliminate the source of trouble.

Casting in Metal Molds

William B. Scott/*Engineer National Bearing Div., American Brake Shoe Co.*

■ In considering die casting and permanent mold casting, confusion may be avoided by referring to definitions more common in European countries than in our own. In either case, the basic supposition that the mold is used repeatedly is an essential part of the definition. In permanent mold work, the mold cavity is filled by gravity, hence the European term *gravity die casting*. In this country we reserve the term *die casting* for the pressure casting processes.

The pressure casting process employs two kinds of machines (1) the goose neck type in which a plunger works within a special chamber which in turn is immersed wholly or partly in the molten metal, and (2) the cold chamber machine in which the plunger and charging cylinder are independent of the molten bath. Between these methods there are various shadings of practice including the vacuum die casting process whereby metal is forced into an evacuated mold by the normal atmospheric pressure over the crucible source of metal. Permanent molding rigs may approach pressure die casting machines in their complex mechanization directed toward opening and closing the mold and ejecting the casting.

The economic position of any one of these casting methods may be judged by the extent to which it is used. Die materials place a limit on the metals that may be cast. Some experimental work has been done in metal-mold casting of steels but to this writer's knowledge there has been no commercial production. A few plants make a fair volume of permanent mold cast iron castings, but their total production is probably far less than one per cent of the total gray iron.

Department of Commerce figures show that something between five and seven per cent of the copper-base alloys are cast in permanent molds but this includes bushing and bar stock to leave but a small percentage for other types of permanent mold work. Pressure die casting in copper-base alloys probably accounts for one to two per cent of the total volume.

In the aluminum alloys the story is quite different. Approximately 40 per cent of all production is in permanent molds, 30 per cent in sand casting, and 30 per cent in pressure die castings. The magnesium alloys are still made primarily in sand. Zinc alloys are practically all pressure die cast. A special type of permanent mold or pressure casting is the slush casting in which the mold is dumped immediately upon pouring, leaving just a shell of solid metal.

Section thicknesses are difficult to define as to standards. Permanent mold castings are being made with minimum thickness of 0.060 in. or less but the area of the section and the relationship to the balance of the casting is as important as the actual minimum dimension. In general, pressure die castings are preferred for thin sections. In regard to tolerances, pressure die castings are generally in the range of ± 0.003 to ± 0.005 in. per inch of section. Permanent mold castings may be expected to hold within ± 0.005 to 0.010 in. per in.

Mold Maintenance and Replacement

The tolerances held and the quality of the surface finish are functions of the mold design and maintenance and, as such, reflect in the cost. In the brasses and bronzes, mold maintenance and replacement is generally the largest single cost item. Mold life may vary from a few hundred pieces to several thousand. In aluminum, the mold life is greater and generally accounts for but a small part of the unit cost. Here the mold may be good for 50,000 to 75,000 shots.

The same relationship holds in pressure die casting. Indeed, this process has been held back by the lack of suitable die materials for the copper-base alloys.

As far as physical properties are concerned the permanent mold castings are generally superior to all other forms of casting due to the chilling effect of the molds. In many cases, these maximum physical properties are best achieved in conjunction with a modified heat treatment following casting. Shrinks do occur in permanent mold castings but these are generally sharply defined and the skill in mold design should locate the shrinks in some section where their presence will not be detrimental.

Cast-to-size test bars have been made in aluminum bronze which, by accident, were practically hollow tubes. Tensile tests; however, showed that these gross flaws had little effect on the ultimate tensile values reported. In all cases of permanent mold or die castings, the best qualities are present in the surface sections, and these castings may be used in the as-cast dimension. Frequently, sand castings, by comparison, are machined to remove the better structure leaving only the weaker, cored areas.

Seven huge cores are first of 89 cores put into one of molding pits for mold of one of four 38,000-lb cases cast for centrifugal pumps at Torrance, Calif.

Large Casting Poured in West

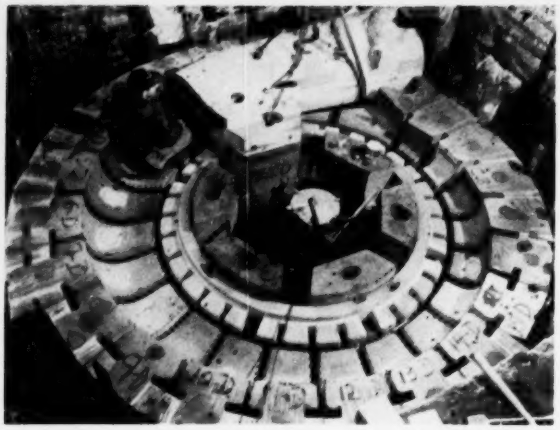
The largest single-piece pump castings ever produced on the west coast were recently poured at National Supply Company's Torrance (Calif.) plant. These pumps are components of the 457-mile Colorado River aqueduct system, and are among the largest and most intricate steel castings that can be produced anywhere.

In service, the impeller inside the case lifts 90,000 gallons of water per minute to a height of 300 ft, producing what is thought to be a world record combination of volume and pressure. It is driven by a 9000-hp electric motor.

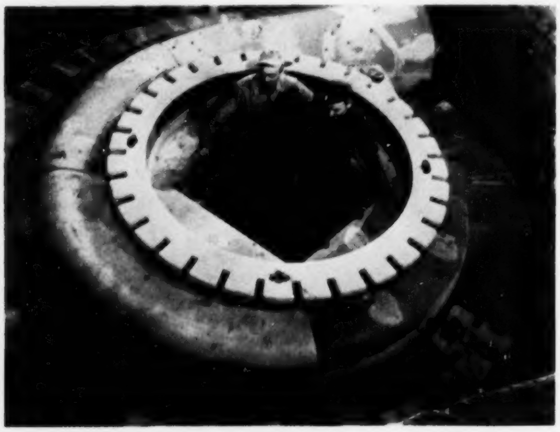
With the addition of four new pumps in the system, as much as 650,000,000 gallons of water can be delivered daily to the Los Angeles area, enough for 4 million persons at 162 gallons per person per day. To deliver this volume, the pumps must lift the water more than 1600 ft in five steps. More than 100 tunnels along the route eliminate pumping to even greater heights.

Pump cases are approximately 10 ft outside diameter, 14 ft 4 in. over discharge flange, and weigh 38,000 lb. Although size and weight are impressive, the pumps would be much larger and heavier except for engineering design and foundry production methods that permit lower weight while maintaining a high safety factor.

After setting all the drag cores in molding pit, loose particles of sand are removed by vacuum cleaner. T-shaped reinforcing ribs will be formed in openings shown in outside cores of mold. Toothed ring core will form internal pockets in pump case.

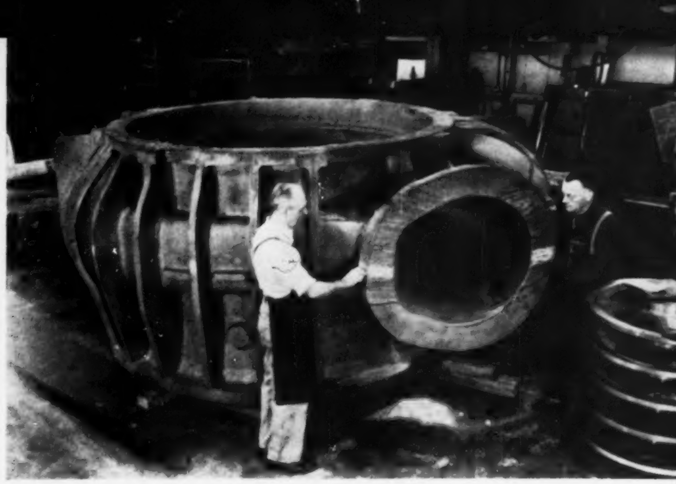


First of cores that will form water passage and internal hydraulics of 38,000-lb pump case is placed in position with aid of an overhead crane.

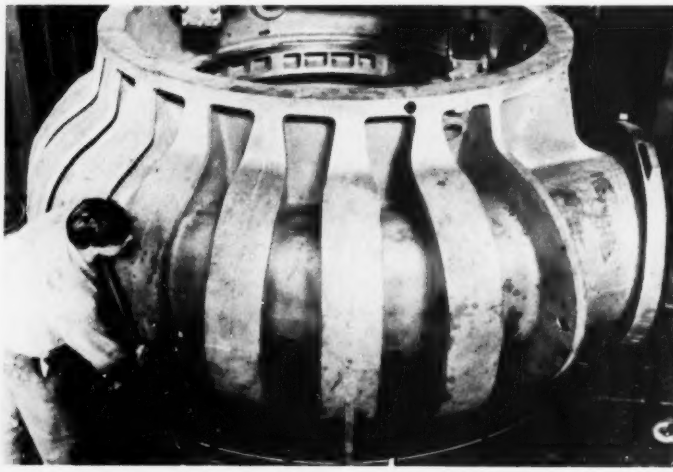


Now, the second "toothed ring" core, which is designed to form internal pockets in the pump case, is shown in position on top of the cores. Pumps are components of Colorado River aqueduct system to Los Angeles.

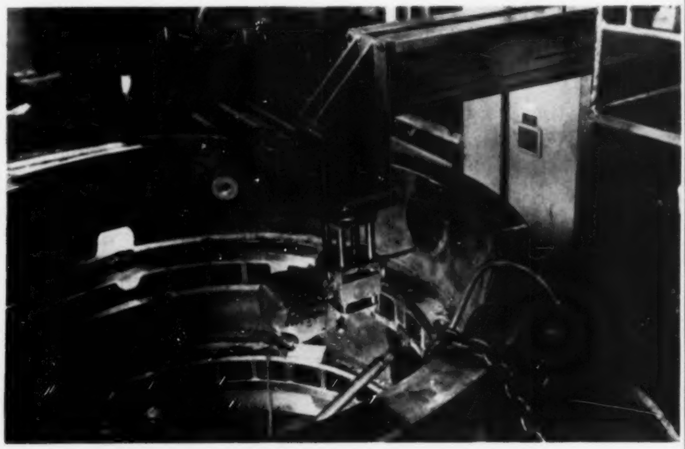
At this stage, only a few more of the 89 cores for huge pump casing are yet to be placed before mold is closed. Pumps would be much larger and heavier except for engineering design and foundry production methods that reduce weights while retaining dimensional accuracy.



To obtain finished casting ready for machining, molten steel was produced in the largest of National Supply's three electric furnaces. After cooling, casting was removed from mold, risers and gates burned, cut and ground off, and casting cleaned and heat treated.



Internal diameters of pump case were turned on vertical boring machine with table of 120-in. diameter. Foundry engineering minimized machining operations.



Most of machining on pump case was done on 7-in. spindle, floor type, horizontal boring, drilling and milling machine, largest in National Supply plant and also on the west coast. Reverse drilling was done by means of an under-arm support with attachment.

AFS Board of Directors Submits By-Laws Revisions

THE first general revision of the Society's by-laws since 1948 are being submitted to the membership on October 1 for letter ballot, as ordered by the Board of Directors acting in accordance with the present by-laws, Article XX—Amendments. Because of broad interest in all AFS activities, and the importance of several proposed revisions affecting the Chapter membership, a heavy vote is expected prior to the announced deadline of October 31.

Two Major Revisions

As endorsed by the Board of Directors meeting July 24, the proposed amendments include two major revisions: establishment of "Regions" of the Society with all Chapters designated in "Chapter Groups" therein, and reorganization of the Board of Directors for more equitable and constant regional representation by Directors. The two proposals, necessarily interdependent, were approved after months of study and discussion.

At the outset, five Regions and 18 Chapter Groups are proposed, it being intended that each Chapter Group shall have constant representation on the Board. A Regional Vice-President is to be appointed by the Board for each Region, from among the National Directors in each Region. The original districting of Regions and Chapter Groups, once the plan is approved by member ballot, will be as follows:

Proposed AFS Regions

Region No. 1 (5 Directors, 5 Chapter Groups): *Group A*—Metropolitan Chapter, New England area; *Group B*—Philadelphia, Chesapeake Chapters; *Group C*—Eastern New York, Central New York, Rochester, Western New York Chapters; *Group D*—Eastern Canada, Ontario Chapters; *Group E*—Northwestern Pennsylvania and Canton Chapters, Pittsburgh area.

Region No. 2 (5 Directors, 5 Chapter Groups): *Group F*—Northeastern Ohio Chapter; *Group G*—Central Ohio, Cincinnati Chapters; *Group H*—Detroit, Toledo Chapters; *Group I*—Saginaw Valley, Central Michigan, Western Michigan Chapters; *Group J*—Michiana, Central Indiana Chapters.

Region No. 3 (3 Directors, 3 Chapter Groups): *Group K*—Chicago Chapter; *Group L*—Wisconsin, Twin City Chapters; *Group M*—Central Illinois, Northern Illinois-Southern Wisconsin, Quad City Chapters.

Region No. 4 (3 Directors, 3 Chapter Groups): *Group N*—St. Louis, Mo-Kan, Corn Belt, Timberline Chapters; *Group O*—Tennessee, Birmingham, Mid-South Chapters; *Group P*—Texas, Tri-State, Mexico Chapters.

Region No. 5 (2 Directors, 2 Chapter Groups): *Group Q*—Southern California, Northern California Chapters; *Group R*—Oregon, Washington, British Columbia Chapters.

In setting up Regions and Chapter Groups, natural geographic areas and average members per Director were considered. Thus Region No. 1 includes 11 Chapters, averaging 594 members per Director; Region No. 2, 10 Chapters and 609 average members; Region No. 3, 6 Chapters, 695 average; Region No. 4, 10 Chapters, 455 average; Region No. 5, 5 Chapters, 391 average.

Relief for AFS Officers

A major purpose of the regional plan is to relieve the AFS President and Vice-President of as much official time and duties as possible, spreading the load among the five Regional Vice-Presidents who will act as official representatives of the Society in their respective areas. In recent years the heavy demands made by AFS on its elected officers has discouraged many qualified executives from accepting these posts. Through the medium of "regional administration meetings," more effective liaison should be maintained.

The proposed regional plan is rather unique among technical societies, although well known in trade associa-

continued on page 102

H. Bornstein
Chairman, By-Laws Comm.

M. A. Fladoes
Chairman, Reorgn. Comm.

Make the Foreman Part of Your Incentive System

John Taylor / *Vice-President, Lester B. Knight & Assoc., Inc.*

Time study, motion analysis, and incentive systems—all valuable management tools—must be properly used to produce best results. Progressive foundry managements thus have come to realize that such tools will be used most effectively and the business will profit most when foremen and supervisors are trained to know the real details of motion analysis, time study, and the basic principles involved in the application of incentives to the activities they supervise.

■ Time and again it has been demonstrated that when foremen realize, through training, what can be accomplished by a good motion analysis study or an activity study on some particular operation, they look for and find other improvements which also can be made.

In addition, foremen who have received proper training relative to the department incentive plans, answer the questions of operators and union stewards and prevent dissatisfaction. In being able to answer such questions the prestige of the foreman as well as the workers' respect for him, are increased. He then, of course, is in better position to sell the system to them. In addition, management benefits from having supervisors trained to use the proper tools for accurate estimating.

Educating supervisors on this subject is neither costly nor time consuming. Usually it is not necessary to take the foreman away from the job for an extended period in order to give him an intensive training on time study and incentives, although this has been done in some of the larger foundries with excellent results. Where such training can be accomplished, the man returns to the job with a broader knowledge of management requirements, plus an inspiration to look for details which ordinarily would not be noticed.

No foreman should be expected to take time studies in his department, but the results of the training will save much time for both the time study and personnel departments. And the foreman is more likely to institute methods improvements on his own initiative.

When it is not possible to provide a training program over an extended period, which frequently is the case, weekly meetings can help to broaden the knowledge of the foreman and enable him to do a much better job. It also will provide a needed stimulant in the attitude toward management, in general, and the realization that he is a part of it. Foremen not only are the men on the "front line" but also the logical source for future executives. Top management therefore can strengthen its position by increasing the knowledge of the supervisory group.

A Broad View

Meetings of approximately one hour's duration can be held each week, either on a general discussion basis or with a qualified leader. In meetings of this kind, too much time should not be spent on fundamental details, but rather on a broad view of the subject. A suggested program, for approximately six or seven meetings might be as follows:

1. Origin of time study; several kinds of incentive systems.

2. Hazards of estimated prices; the necessity for time studies; value of methods anaylsis; how these subjects are taught in colleges.

3. Recognition of allowances for fatigue, personal, supplemental, balance and incentive; the use of levelling factors and why they were developed.

4. How a time study is made; actually taking one or two simple studies in the meeting room.

5. The use of studies to build standard data; development of constant and variable values; compiling the data for an operation.

6. Actually setting some time standard by standard data; the many uses of standard data.

7. Checking accuracy of the data by a "proof sheet"; the completed standard data or "spec sheet".

The continued use of specification sheets serves the dual purpose of outlining the specific steps required to complete the cycle of work, and the development of the time standard for the particular operation. It should be noted that most "spec" sheets are for a specific operation. Other "spec" sheets must be developed for all other specific operations.

Foreman training is essential to the installation and successful use of a new time study, methods, or incentive program to eliminate delays, misunderstandings and even mistrust of the engineer or the system. These reactions do exist and management should make every possible effort to dispel them, and the reasons for them, through a properly planned training program in the fundamentals involved.

People are not skeptical of a good program or of a good tool when properly trained in its use. This is true in all walks of life, and it has been demonstrated that, when applied to foundry supervision, the problems of time study and incentive diminish or disappear.

Calendar of Future Meetings and Exhibits

October

8-9. . Michigan Regional Conference
Michigan State College, East Lansing, Mich. Sponsored by A.F.S. Central Michigan, Western Michigan, Detroit and Saginaw Valley Chapters and Michigan State and University of Michigan Student Chapters.

8-9. . American Society for Quality Control
Masonic Temple, Davenport, Iowa. Eighth Midwest Conference.

8-9. . Gray Iron Founders' Society
New Hotel Jefferson, St. Louis. Annual meeting.

9-15. . 5th International Congress of Mechanical Manufacture
Turin, Italy. Production methods and parts assembly.

15-17. . Foundry Equipment Manufacturers' Association
Greenbrier, White Sulphur Springs, W. Va. Annual meeting.

16-17. . Northwest Regional Conference
University of Washington and New Washington Hotel, Seattle. Sponsored by Washington, Oregon, and British Columbia Chapters, and University of Oregon Student Chapter.

19-21 . . American Institute of Mining and Metallurgical Engineers
Hotel Allerton, Cleveland. Fall meeting of Institute of Metals Div.

19-23. . American Society for Metals
Cleveland Auditorium, Cleveland. 35th National Metal Exposition and Congress.

23-24 . . New England Regional Foundry Conference
Massachusetts Institute of Technology, Cambridge, Mass.

23-24 . . National Noise Abatement Symposium
Illinois Institute of Technology, Technology, Center, Chicago.

29-30. . Metals Casting Conference
Purdue University, West Lafayette, Ind. Sponsored by Central Indiana and Michiana Chapters, Purdue University, and the Purdue Student Chapter.

November

4-6. . Steel Founders' Society
T & O Conference.

29-Dec. 4 . . American Society Mechanical Engineers
Statler Hotel, N.Y.

December

2-4 . . American Institute of Mining and Metallurgical Engineers
Netherland Plaza Hotel, Cincinnati. Electric Furnace Steel Conference.

13-16 . . American Institute of Chemical Engineers
Hotel Jefferson, St. Louis. Annual meeting.

January

22 . . Malleable Founders' Society
Hotel Cleveland, Cleveland. General meeting.

Host Chapter and Apprentice Committees Plan for Convention

PLANNING for the 1954 AFS Convention and Exhibit, to be held in Cleveland's Public Auditorium during the week of May 8-12, reached the active stage in September. On the 10th, officers and directors of the host Northeastern Ohio Chapter met with representatives of AFS National Headquarters at Cleveland's Tudor Arms Hotel to arrange for the appointment of Host Chapter Convention Committees.

The Board of Directors of the Host Chapter will release the names of those individual members selected to serve on the following committees: General Convention, Reception, Plant Visitations, Banquet, Publicity, Shop Course, and the Ladies Entertainment Committee.

The willingness of members of Northeastern Ohio Chapter to serve on Convention Committees has been a decided factor in the success of AFS Conventions held in Cleveland in the past. This tradition of co-operation and group effort will insure that the 1954 Convention and Exhibit will be staged under the most desirable circumstances.

Apprentice Contest

While Host Chapter committees are being selected and details of exhibit hall floor planning are being processed, the AFS Apprentice Contest Committee is implementing its phase of the 1954 Convention. A meeting held at the Hotel Sherman, Chicago, on May 5 resulted in a discussion of the operating procedure and selection of drawings for metal pattern, wood pattern and molding divisions.

Chairman R. W. Schroeder of the University of Illinois, Navy Pier Branch, Chicago, presided over the meeting. It was suggested that the Contest be conducted on the Chapter level on a "new-man-in-industry" basis rather than strictly on an indentured apprentice basis, as in the past. Only those entries made by regular apprentices or trade or vocational school students would be submitted for judging in the National Contest, however. The Birmingham Chapter used this basis for the 1953 Contest.

The question of length of apprentice's training as a factor in the judging was raised. The ensuing discussion brought out the fact that in recent years first-year apprentices have won the Contest prizes, indicating that length of training need not be considered by the judges. Nevertheless, this question is raised almost every year.

The National Apprentice Contest carries with it prizes of $100, $50, and $25 for first, second, and third places, respectively, awarded to the winners of each contest division: Gray Iron Molding, Steel Molding, Non-ferrous Molding (light and heavy alloys), Wood Patternmaking, and Metal Patternmaking. A score of 88 points minimum is required for first prize winners, 85 points for second prize, and 76 points for third. The first place winner in each division is given paid, round-trip rail and Pullman transportation between his home and the convention city, as an award by the Society. All other costs must be paid by the winner, his company, or his Chapter.

Annual Competition

The Apprentice Contest is designed as an annual competition to stimulate interest in apprentice training and craftsmanship in patternmaking and the foundry industry in general. Neither the apprentices nor the companies to which they are indentured are required to be members of American Foundrymen's Society.

The Contest is conducted annually under the direction of the Apprentice Contest Committee of the AFS Educational Division. This Committee handles all phases of the competition, which is culminated in the awarding of prizes at the Annual Business Meeting of AFS, held during the Convention.

Members of the Apprentice Contest Committee for 1953-54 are:

Roy W. Schroeder, *Chairman*, Laboratory Instructor in Foundry Practice and Patternmaking, University of Illinois, Navy Pier Branch, Chicago.

George E. Garvey, *Vice-Chairman*, Vice-President, City Pattern & Foundry Co., South Bend, Ind.

Joseph E. Foster, *Secretary*, Technical Assistant, American Foundrymen's Society, Chicago.

F. W. Burgdorfer, President, Missouri Pattern Works, Inc., St. Louis.

Ralph M. Lightcap, General Manager, Rupp Pattern Co., Rockford, Ill.

E. J. McAfee, Master Patternmaker, Puget Sound Naval Shipyard, Bremerton, Wash.

Vaughn C. Reid, Vice-President, City Pattern Foundry & Machine Co., Detroit.

G. Ewing Tait, Foundries Manager, Dominion Engineering Works, Ltd., Montreal, Can.

John J. Thompson, Asst. Foundry Supt., Fletcher Works, Inc., Philadelphia.

A heavy spray of water precipitates dust at the grinding wheel. Good safety practice interconnects power for wheel and water supply so wheel cannot be operated without water.

Foundry Safety Practices

This article is condensed from the introduction to the new dust and ventilation control manual, which is being prepared for early publication by the Dust & Ventilation Control Committee of AFS.

■ The American Foundrymen's Society, recognizing the present day exigencies of the industry it represents, constituted the committee on Safety, Hygiene, and Air Pollution in September 1950. The committee was charged with the job of formulating a code of good practices in these three related fields. The objective is to make the foundry a better place to work; to enable the industry to be better neighbors in the community.

The Society recognized that the industry has a moral obligation to prevent accidents and to eliminate occupational disease; that it must do its part in controlling air pollution by taking such steps as are practical according to financial means.

Today, management knows that it must provide safe and healthful working conditions if it is to succeed; and that it is better for an industry to establish its own standards of safe practices than to wait and have them imposed by others who are not as familiar with its specific problems.

Adherence to a program designed to eliminate accidents and occupational disease is not merely a desirable frill but is just good business. Whether one is self-insured or not, accidents and occupational disease are expensive in medical, compensation, and production costs. These, at times, are hidden, but careful analysis will show them to be surprisingly high.

Furthermore, it is in the interest of the Foundry Industry to improve working conditions in order to obtain a competitive advantage. The better workmen will not be attracted to the foundry, or if they are, they will not stay unless there is some assurance of freedom from injury and sickness. High employment turn-over is costly.

There is a great investment in supervisors and skilled workmen and it is good business to keep them on the job. If the money were available every machine and piece of equipment in the foundry could be replaced but not so, good production people.

Law suits for injury and damage caused by air pol-

lution might be more expensive than control. Pollutants, such as beryllium, lead, phosphorus, iron oxide, phenol, etc., from foundry operations can quite readily cause neighborhood damage and even personal illness.

By reason of the foregoing, the work of the committee has been directed towards formulating this code of prevention and control. The members thereof are people who are either working in the foundry industry or are closely associated with it as equipment suppliers. Consequently they are familiar with the specific problems of producing castings.

The recommended good practices developed here are based on present day knowledge of the principles of safety, hygiene, and air pollution. It is subject to revision when and if new data or conditions indicate. The recommendations of this code must be practical if they are to be adopted and effective if they are to be of benefit. There are many potential hazards to health in foundry practice but only the more common and principal ones are treated here.

Most foundries are not equipped to make environmental measurements, but threshold limits enable the foundry man to ascertain the relative toxicity of the principal contaminants in his plant. For instance, it will be seen later that 66 times as much iron oxide can be tolerated in the atmosphere as lead.

Medical Protection

In regard to the medical phase of worker protection, good practice suggests as minimum:

(1.) Pre-placement physical examination and chest x-ray. This enables management to place an employment applicant on a job suitable for him without endangering fellow employees. For example, a man without depth perception hardly qualifies as a crane operator.

(2.) Annual physical examination and chest x-ray. This practice keeps the Company's physician informed of the state of a man's health so that incipient disease can be arrested early; reclassification of employment can be made; or other action can be taken as indicated by the examination. This redounds to the benefit of both the employer and employee.

(3.) Adequate first aid facilities in case of injury or illness. The benefits of first aid should be obvious.

The following sections indicate when remedial measures are required and how they can be accomplished.

Casting Industry Health Hazards

Acrolein (acrylic aldehyde)

This gas forms in foundry operations from the thermal decomposition of core oil. It is very poisonous but has adequate warning properties. It is so irritating to the eyes that man cannot tolerate a concentration that would permanently injure him or cause death. It may be classified as a nuisance gas rather than a toxic material because in practice exposure of five minutes to one part per million parts of air is intolerable. The maximum allowable concentration is 0.5 part per million parts of air.

Hygienic control consists preferably of local exhaust ventilation or air dilution by general ventilation.

Aluminum

Shaver and Riddell (J. Ind. Hyg. Tox. 29:145 (1947) have reported a number of cases of lung disease occurring in the manufacture of alumina abrasives. As far as the casting and grinding of aluminum alloys is concerned, the metal may be considered nonpoisonous.

The principal danger is from fires and dust explosions in dust collecting systems.

Antimony

Cases of industrial poisoning from antimony are rare. It is difficult to obtain a clear picture of symetomatology and in founding operations it probably is an unimportant contaminant. Men exposed to antimony fumes and dust have developed dermatitis and ulceration of the nasal septum.

The maximal allowable concentration is 0.5 milligram of antimony per cubic meter of air, a value not likely to be encountered with the percentages of antimony used in founding today.

Beryllium

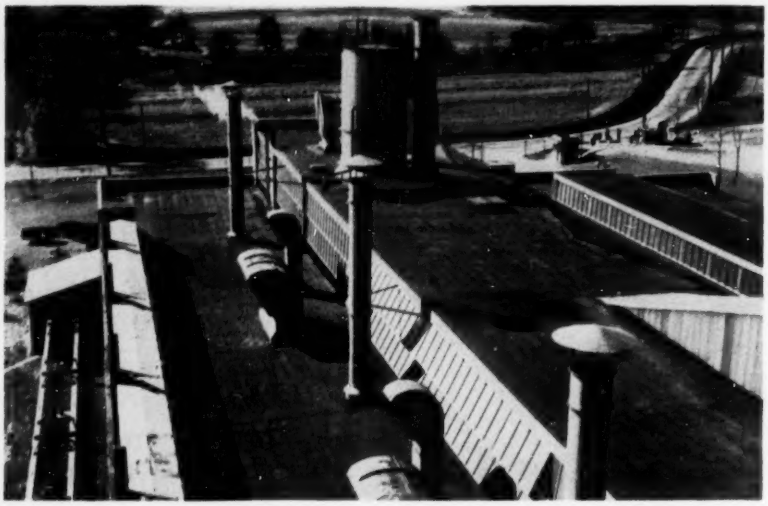
It is only in recent years that this metal was recognized as an industrial hazard. In 1945, 170 cases of illness occurred in certain Ohio beryllium plants. Five of these people died. Many cases have been reported from other areas which have been sufficiently authenticated. One can conclude that beryllium is very toxic even though the National Institute of Health bulletin No. 181 published in 1943 indicated that there is no specific toxic action attributable to the beryllium ion.

There are two manifestations of beryllium poisoning: the acute pulmonary disease similar to pneumonia and a delayed chemical pneumonitis now usually called pulmonary granulomatosis.

Most of the cases reported in the literature occurred in the fluorescent lamp manufacturing industry where the exposure was to beryllium phosphors; but six cases of typical pulmonary disease due to the metal were reported from one plant engaged in casting a 5% beryllium copper. Four of these six cases died. Beryllium copper castings manufactured today contain about 0.30% beryllium and to date no hazard to health with *this* alloy has been demonstrated.

From the data presently available, it appears that only a few persons are susceptible to chronic berylliosis and that mere traces of the metal in the atmosphere can produce symptoms in them. A susceptible person may show symptoms when exposed to the extremely low value of one microgram per cubic meter of air. Authenticated "neighborhood cases"—people who live near the beryllium plant—seem to substantiate this, since they were exposed to extremely low concentrations of dust.

There are no sufficient data available upon which to base a maximal allowable concentraticn but some investigators believe that in-plant atmospheric concentrations should not exceed 2 micrograms per cubic meter of air as an average for an eight hour day, and no one should be exposed to a concentration in excess of 25 micrograms per cubic meter of air for any period however short. These are extremely minute values and to maintain an environment so free of con-



Building ventilation balance is of vital importance in air pollution control. This modern foundry has multi-wash dust collector with discharge stack, mold conveyor ventilating hood discharge stacks, compensating air supply units for efficient operation.

tamination requires exceptionally good dust control, housekeeping, and personal hygiene.

When compounds of beryllium come in contact with cuts or abraded surfaces of the skin, deep ulcers are formed which are very slow in healing and treatment sometimes requires complete surgical excision to effect a cure.

An interesting feature of beryllium poisoning is the delayed effect which sometimes occurs. The onset may be delayed for many months or years after the final exposure of the patient. Mortality is high.

Becase of the mysterious nature of the effects of this metal on man, foundries engaged in the production of beryllium-copper castings—if they do not have an industrial hygiene staff—would do well to use an industrial hygiene consulting service or their State unit of the U. S. Public Health Service, which is free, in establishing a regimen of atmospheric control.

As far as medical procedures are concerned the following are suggested.

(1.) Preplacement examinations.

(2.) Periodic examinations
   a. Weekly for employees where acute intoxication is possible, monthly for those where chronic poisoning might occur.
   b. X-Ray of chest every six months.
   c. Special examinations upon presentation of complaints or on persons who have undergone surgical operations.

(3.) Termination examinations.

The periodic examination should include weight, vital capacity, breath holding test, examination of skin, examination of nose and throat.

It has been recommended that applicants with the following abnormalities be rejected for employment where a beryllium exposure is possible: chronic cough; chronic respiratory infection; chronic malaria; disease of liver, kidneys, or heart; abnormal blood pressure.

Great stress seems to be placed upon the immediate investigation of any worker in whom there develops cough, pain or tightness of the chest, anorexia, loss of weight, or shortness of breath.

Chromium

Air contaminated with chromic acid mist or with chromates or dichromates is the principal exposure to chromium in industry. In this form it causes chrome ulcers and dermatitis.

In founding, particularly in the manufacture of stainless steel castings, chromium is present in the air as the element or as a chromic salt (chromic oxide Cr_2O_3). Exposures occur from melting, gate and head burning, and grinding. Elemental chromium or chromic oxide have not been conclusively demonstrated to be toxic. There is some evidence that this oxide can be irritating to the nose and throat and both the element and the oxide can produce dermatitis.

Systemic diseases definitely traced to chromium compounds are rare. Some investigators have noted a high incidence of pulmonary carcinoma amongst workers who were exposed to chromates rather than to elemental chromium or chromic oxide.

Little difficulty from chromium has been experienced in the manufacture of ferro-chrome castings except mild irritation of the nose and throat in susceptible persons working as burners.

The maximal allowable concentration for chromic oxide is 0.1 milligram per cubic meter of air. This value is easily exceeded in the case of unexhausted burning and grinding operations involving ferro-chrome castings.

Cobalt

No proven cases of industrial intoxication have been reported and no threshold limit has been established for this metal.

Radioactive cobalt, however, is now used in the foundry industry in place of radium to radiograph castings. Radiation hazards are the same as those of radium and the Atomic Energy Commission will not release radio-active cobalt to industry unless the A.E.C. safeguards are complied with.

The serious effects of exposure to excessive radiation are well known and the established tolerance dose is 200 milliroentgens per week based on a forty hour week.

In practice, foundrymen using radio-active isotopes

will be guided by the protective regulations of the Atomic Energy Commission and other agencies.

Fluorides

Fluorides, sometimes in the form of cryolite (sodium aluminum fluoride) are used in the manufacture of ductile iron and magnesium castings. They are classified as protoplasmic poisons.

Various degrees of respiratory irritation may result from the inhalation of fluorides in the form of dust. This is accompanied after a few minutes by a discharge from the nose or nose bleed. No such effects are noted when the concentration does not exceed 2.5 milligrams per cubic meter of air which is the threshold adopted in the United States.

Dental fluorosis—mottling and discoloration of the teeth—occurs also when the maximal allowable concentration is exceeded for a long period of time.

Cryolite is much less soluble in body fluids than is sodium fluoride and consequently, the danger of physiological effects is less with cryolite than with the more soluble fluorides.

In the manufacture of ductile iron or magnesium castings, the threshold limit is easily far exceeded which is hazardous. Exhaust ventilation is usually indicated at the station where inoculation occurs.

Iron Oxide

Fumes and dust of iron oxide occur during melting, burning, pouring, grinding, welding, and machining operations connected with the manufacture of all ferrous castings. Exposure is particularly high when manganese steel castings are involved.

Iron oxide is physiologically inert but it produces a pulmonary condition called siderosis which is non-disabling. Particles of iron oxide are radio-opaque and produce nodular shadows in a chest roentgenogram that resemble the discrete fibrotic nodulation of silicosis. As a result cases of siderosis are frequently confused in radiographic diagnosis with silicosis, a disabling disease, and compensation awards have been made on the basis of x-ray evidence alone when actually no disability was sustained.

The nodular shadows of siderosis may be compared to a tatoo mark an the arm. They are permanent but there is no loss of function. In severe exposures—80 milligrams of iron oxide per cubic meter of air—siderosis can be produced in as short a time as one year.

In founding, the job exposures are in the following order of severity:

(1.) Burning. (2.) Grinding. (3.) Welding. (4.) Machine grinding. (5.) Pouring. (6.) Melting.

The recommended maximal allowable concentration of iron oxide expressed as Fe_2O_3 is 10 milligrams per cubic meter of air per 8 hour day. In all of the job exposures listed, the threshold limit will usually be greatly exceeded unless adequate exhaust ventilation is provided. In the case of machine grinding operations, exposures can sometimes be controlled by adding a wetting agent to the coolant.

Lead

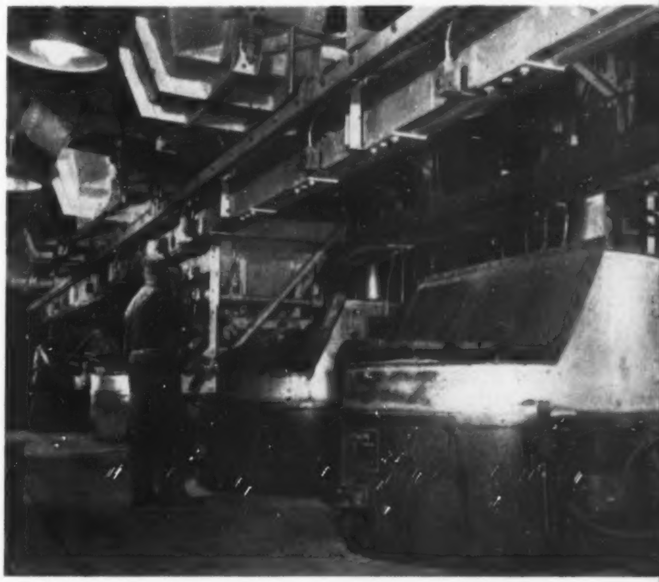
In non-ferrous founding, this metal presents the greatest hazard to health. All compounds of lead are poisonous but in varying degrees according to their solubility in tissue fluids. The low incidence of lead intoxication among miners of galena (lead sulphide) is probably due to the very low solubility of lead sulphide in the tissue fluid of the lungs.

In foundry processes, it is evolved as lead oxide in melting, pouring, and welding operations. This is a very soluble form. In cleaning and machining operations, it occurs in the dust formed as elemental lead which is not as soluble as the oxide. If atmospheric concentrations were of the same order of magnitude, the incidence of lead poisoning will be greater where the oxide is the contaminant.

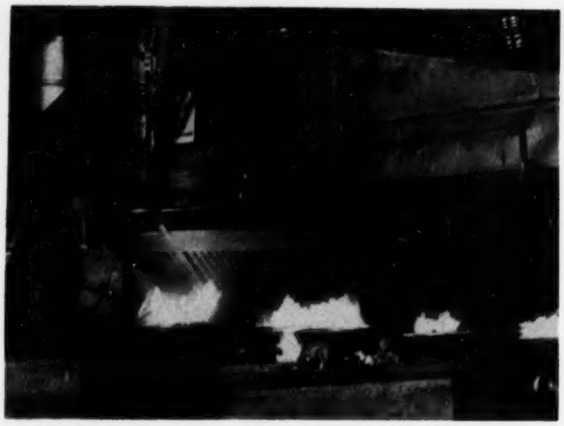
Lead Concentration

The maximal allowable concentration for lead adopted in the United States is 0.15 milligrams per cubic meter of air. This standard does not take into consideration the degree of solubility of the various lead compounds. In foundry work, if the average atmospheric concentration of the oxide is kept to 0.15 milligrams per cubic meter of air, men can work in that exposure for a life time without experiencing symptoms of lead intoxication. At 3.0 milligrams per cubic meter, poisoning may occur in suspectible persons. At 5.0 milligrams per cubic meter, most workers will experience symptoms more or less serious. In practice these values are sometimes difficult to meet without adequate exhaust ventilation. Even in the manufacture of "pure" copper castings there is often sufficient lead present as impurity to produce atmospheric concentrations of lead of the order named.

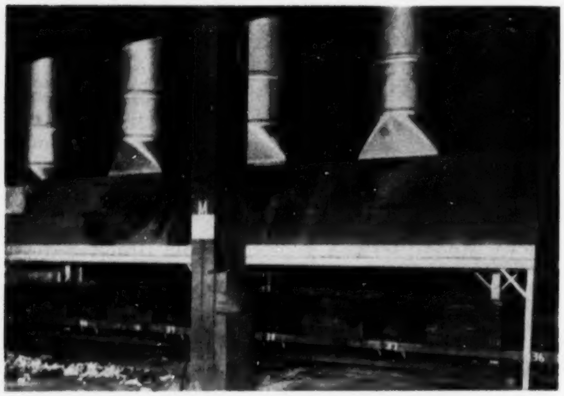
The literature is replete with data on the etiology, diagnosis, control, and treatment of lead intoxication. It is sufficient to state here that in the production of alloy castings containing lead, there is always a serious potential hazard to health especially in the melting, pouring, cleaning, and machining opera-



These hooded core sand mixers require only sufficient air volume to convey the dust and maintain adequate velocity to prevent escape of dust into the room.



Compensating uniform flow pouring hood (above) affects path of flaming hot gases. Open-side smoke-off exhaust hood (below) is made possible by compensating air. High velocity air prevents fumes from spreading.



tions. In any non-ferrous casting work, where lead is present as a "trace" metallurgically, there may be a hazard to health.

Lead can enter the body by ingestion or by inhalation so that even in the case of good dust control, cases of lead intoxication can occur, if food is permitted to be eaten in the foundry or liquids drunk from open containers, such as milk bottles. Foods and liquids may absorb lead dust and fume in sufficient amount to produce poisoning. Industrial experience has shown that such practice is unwarranted.

Magnesium

Apart from its inflammable nature, magnesium has not been shown to be poisonous as such. The maximal allowable concentration is 15 milligrams per cubic meter of air.

Fire and explosion is an outstanding hazard.

Manganese

Acute intoxication is almost unknown and chronic poisoning, a very disabling and serious condition, is rather infrequent industry-wide. Well established cases fail to respond to treatment.

In founding, manganese is usually associated with the production of manganese steel castings and manganese bronze. The maximal allowable concentration is 6.0 milligrams per cubic meter of air. This value is seldom exceeded in the foundry industry even in the case where no exhaust ventilation is provided.

Phosphorus

This element is used in the manufacture of phosphor-copper. Acute poisoning from phosphorus has not been demonstrated. Chronic poisoning occurs slowly following inhalation of fumes. It is believed that necrosis of the jaw occurs when phosphorus enters the system by way of carious teeth. Pathology of the bones is characteristic of poisoning by phosphorus.

Chronic cases in industry are not uncommon and because carious teeth afford a suitable background for the beginning of the disease, persons with poor dental hygiene should not be exposed to the fumes for prolonged periods.

Phosphorus ignites spontaneously in air to form phosphorus pentoxide (P_2O_3) and must be stored under water. Because of the ignition characteristics, burns frequently occur in industry which are often complicated by chronic poisoning because the substance is absorbed from the burned area.

The maximal allowable concentration is 0.1 milligram per cubic meter of air. This limit may easily be exceeded during the phosphorizing phase of melting phos-copper. Local exhaust ventilation is usually indicated.

Resins

With the advent of shell molding, more resins are used. They are of the thermosetting type. That is, once the resin is cured, it cannot be softened or remolded. There are various types on the market such as the phenol-formaldehyde and urea formaldehyde resins. Some contain hexamethylenetetramine.

The phenol-formaldehyde resins on heating give off odors of phenol and formaldehyde. Urea decomposes to ammonia and carbon dioxide so that in shell molding one often notices a distinct odor of ammonia. Hexamethylenetetramine releases formaldehyde. All of these are poisonous, but in severe concentrations, man cannot tolerate them. In practice then, fumes from the resins will be at most a nuisance rather than a hazard and the degree of nuisance will indicate whether exhaust ventilation is justifiable.

All resins are primary skin irritants and are capable of producing dermatitis in susceptible persons.

Sea Coal

This is a common facing used in the foundry and usually contains less than 2% free silica. It is principally carbon. Carbon dust gives rise to a pulmonary condition called anthracosis which is responsible for characteristic shadows in a chest radiograph. It has been considered as a relatively harmless condition. Recent research, however, has indicated that it may be a true disease.

When carbon dust is associated with silica dust as an atmospheric contaminant—and it usually is in foundry practice—an exposure results that is capable of producing a true disease entity known as silico-anthracosis.

Permissible dustiness for sea coal and for mixtures of sea coal and silica depends on the percentage of

The pouring zone in any foundry is a potential danger area. Adequate safety precautions and fume controls will minimize accidents.

free silica present. Safety factors are variable.

A formula commonly used for determining the maximal allowable concentration for a mixed dust is as follows:

$$\frac{\text{(dust count found) (\% free silica)}}{\text{8 hour day}} = \frac{\text{5.0 million particles/cu. ft. of air}}{\text{8 hour day}}$$

However, even though by this formula, a supposed safe atmosphere could result with a dust count of 100 million particles per cubic foot of air, for good industrial hygiene and an acceptable environment, a dust count should never exceed 50 million particles per cubic foot of air per 8 hour day. If it does, dust control is inadequate.

Silica

Silica is one of the principal atmospheric contaminants in the foundry. The chemically combined silicas, other than asbestos, are regarded as being physiologically inert. Thus silicates such as bentonites, slag wool, etc., are not known to produce disabling disease.

Free silica (SiO_2) does cause the occupational disease known as silicosis which is characterized radiographically principally by nodular shadows due to true fibrosis of the lung tissue and clinically by decrease of pulmonary function. It can be disabling. It is especially serious when accompanied by tuberculous infection.

Usually three factors must be present simultaneously to produce the disease:

(1.) Duration of exposure. Two to twenty years are required depending on degree of exposure.

(2.) Respirable particle size. Particles of free silica in excess of 5 microns in diameter are not regarded as being physiologically significant because they are too large to reach the alveoli of the lungs where chemical reaction occurs.

(3.) Concentration of dust. The tolerable concentration depends on the percentage of free silica in the dust. The formula used under "Sea Coal" may be applied here.

In non-ferrous founding, the hazard from silica dust is usually not severe except in the case where silica washes are sprayed on molds and cores or sand conditioning practice is uncontrolled with respect to ventilation. The low incidence of silicosis in non-ferrous work is due to the facts that: the sand is usually in a tempered state during shakeout; there is seldom any burn-in; castings are often shot or sand blasted before grinding and chipping.

In ferrous founding, one of the greatest sources of exposure is the uncontrolled use of silica flour. This material falls in the dangerous particle size range and is usually 100% free silica. Zirconite, which is non-toxic and has a specific gravity of approximately twice that of silica, has been an effective substitute for silica flour in some applications. Because of its density and tendency to flaculate, zirconite dust settles very rapidly.

Sand handling and conditioning systems, shakeout, and sometimes sand slinging operations constitute the principal exposures to silica dust.

Dust sources are usually more severe in mechanized plants but this is offset by the fact that they are more adapted to local exhaust systems.

Good housekeeping is one of the most important ways of controlling the hazard from silica dust. There is good evidence in the literature that the incidence of silicosis is inversely proportional to good housekeeping.

The higher the level of housekeeping, the lower the number of cases of occupational disease.

Silicones

In founding, silicones are used as mold release agents during shell molding. Experience to date indicates that they are not a serious hazard to health.

Non-hydrolyzable silicones used as mold release agents are of a very low order of toxicity. From a practical view point, the hazards from handling them are exceedingly minor. However, silicones are new

chemicals and sufficient toxicological studies have not been made to enable us to state that the non-hydrolyzing types can be ignored.

Although the non-hydrolizing types of silicones appear neither toxic nor irritating, the hydrolyzing types are highly corrosive. From a practical view point, they present hazards from vapor inhalation and contact with the skin and eyes. In dangerous concentrations they have adequate warning properties so that a man could not tolerate an atmosphere that would be harmful to him.

Care should be used in handling the hydrolyzing types since a small droplet splashed in the eye could cause serious damage and even the loss of the eye. Direct skin contact while likely to cause a severe burn is not apt to cause death unless a large portion of the body is exposed.

Because there are many kinds of silicones available, safe practices indicate that those of a low order of toxicity be used as mold release agents. These are the methyl, mixed methyl, and phenylpolysiloxanes.

Solvents (General)

Since there are so many solvents used in the foundry, it is impractical to treat them specifically here. There is no such thing as a safe solvent, except perhaps, water. Some are more toxic than others but all of them can be used safely if the poisonous properties are known and safe handling procedures are followed.

All containers of solvents should have labels attached, giving the chemical name and stating the handling precautions. For example:

CARBON TETRACHLORIDE
DANGER!
HAZARDOUS VAPOR AND LIQUID
MAY BE FATAL IF INHALED OR SWALLOWED

Use only with adequate ventilation.
Do not use in confined unventilated places without protective respiratory equipment.
Do not breathe vapor.
Avoid prolonged or repeated contact with skin.
Do not take internally.

Fire and Explosion

Most solvents are flammable so that in addition to their toxic properties, they present the danger of fire or explosion.

Given the chemical (not trade) name of the ingredients, the characteristics and dangers of the solvent can be ascertained. There is a wide range of threshold limits because of varied toxicity factors and maximal allowable concentrations range from 5 parts per million for nitrobenzene to 500 parts per million for petroleum naphtha.

Sulphur Dioxide

Sulphur which is used as a deoxidant in the manufacture of magnesium castings burns to sulphur dioxide. Breathing zone concentrations of the dioxide during the production of magnesium castings vary.

A concentration of 10 parts per million is common and of 50 parts per million rare. The M.A.C. is 10 parts per million.

Continued exposure in excess of the M.A.C. produce inflamation of the respiratory system, increased fatigue, excess acid in the urine, and alteration of the senses of smell and taste.

Exposures to concentrations of the order of 500 parts per million are dangerous to life. In founding, this value will not be reached and concentrations in excess of the M.A.C. are intolerable to man so that he will not remain in an atmosphere dangerous to life.

The gas may be regarded as an irritant nuisance, and depending on degree, exhaust ventilation may be indicated.

Tellurium

Tellurium is used in foundry practice to increase the chill-depth hardness of chilled car wheels, and to improve the machineability of alloys. It is usually used in very small amounts (5 grams to 800 lbs. of metal).

The fumes of the element cause poisoning characterized principally by the garlic odor of the breath, and urine, suppression of sweat, dryness of the mouth, metallic taste, loss of appetite, salivation, and vomiting. Serious industrial poisonings are rare.

Systemic Poisoning

The maximal allowable concentration is 0.01 milligram per cubic meter of air. If foul breath is to be avoided, this value should not be exceeded. Systemic poisoning does not occur unless the exposure is to a concentration of 0.8 milligrams or more per cubic meter of air.

For practical purposes then, the presence or absence of tellurium breath can be relied upon to measure degree of exposure. If this is heeded as an indication of the need of control measures, injurious exposures are not likely to occur, according to Patty. This is confirmed by the experience of others.

Tin

This metal is commonly used in alloys. It is considered non-toxic. The inhalation of tin oxide over long periods may reslt in a benign non-disabling pneumoconiosis known as stannosis. No cases have been reported in the foundry industry.

In practice, it does not present a health problem. No maximal allowable concentration has been established.

Zinc

The inhalation of the fumes of zinc oxide gives rise to a malaria-like illness called brass-founders ague, zinc chills, smelter shakes, or metal fume fever. Recent research has now shown that finely divided oxides of other metals, such as magnesium, can also produce metal fume fever. The illness rarely lasts more than a day, causes no permanent disability, and is never fatal. Immunity is often acquired after repeated exposures.

When brass contains zinc, fumes of the oxide are readily given off during melting and pouring in voluminous amounts because of the low boiling point of the metal.

The maximal allowable concentration is 15 milligrams per cubic meter of air.

Damage totalling over $1.5 million resulted when this plant of Lindgren Foundry Co. at Batavia, Ill. was destroyed by fire.

Fire in the Foundry

PRESIDENT EISENHOWER has proclaimed October 4-10 as National Fire Prevention week. This proclamation and the information that will be disseminated by the National Fire Protection Association and the National Board of Fire Underwriters during this week should be of vital importance to every foundry in the industry.

This special week in October is the anniversary of the great Chicago fire, which occurred on October 9, 1871. The fire gutted the greater part of Chicago and caused the death of 250 people and a property loss in excess of $196 million. On the same day as the Chicago fire, an even larger conflagration killed over 1100 people and almost destroyed the entire county of Peshtigo, Wisconsin.

We do not want to be alarmists and show undue concern in the foundry industry with our program of Safety, Hygiene, and Air Pollution but fire prevention is definitely a part of safety. It is time that every foundry take a new look at its own plant with a view to fire prevention. Certainly most foundries are constructed of fireproof materials, but what about the contents? What is flammable in the foundry?

You have probably read in the newspapers of the recent fire that caused $35,000,000 in damage when a comparatively new fireproof plant was destroyed. This plant was probably designed with all the latest fire-preventive techniques, and yet it burned down completely!

There are many locations in the foundry where welding is carried on, and in all foundries molten metal is handled and open flames are present, so there is a fire potential in every foundry. These conditions must be controlled at all times in order to minimize the possibility of fire. Three recent reports show that fire started in an oil quench tank in the heat treating operation. Not all foundries have this hazard present, but, if so, it is time to make certain that fire prevention devices are installed and in operation.

Another recent instance was a disastrous fire which occurred in the pattern storage building of a comparatively middle-sized foundry that was theoretically of fireproof construction and had top-notch supervision. Yet, fire broke out in the middle of the afternoon.

No one was in the building and investigation showed that the cause of the fire was apparently spontaneous combustion. Wooden patterns were cleaned with solvent before being stored, and during hot weather the flash point of the wooden patterns rises, especially when some residue of the solvent is absorbed into the wood. The storage area burned so rapidly that before control measures could be taken and the fire department arrived the building could not be saved. Over a million dollars' worth of patterns were destroyed. The plant had no sprinkler system or fire brigade.

Even adequate insurance does not solve the problem of interrupted production in case of fire. Customers may understand that their patterns were destroyed in a fire and that the foundry was not directly responsible, and yet there is that lingering doubt that may cause the loss of a customer because of a fire. There is a certain possibility of lost time for employees. Their wages are interrupted, so they definitely have a stake, as well as management, in preventing fires in the foundry.

The insurance companies are certainly going to start looking into foundry fire insurance rates. Every fire that occurs in one foundry is going to be reflected in a raise in the rate for all of the industry. For many years the foundry industry has had fairly equitable fire insurance rates, but only a few fires will cause these rates to climb! Then the time cost of foundry fires will really show up in the

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A Basic Foundry Cost System

EARL PALTENGHI/*Vice-President H. C. Macaulay Foundry Co., Berkeley, Calif.*

Costs . . . what they are . . . how to figure them . . . are of paramount importance in every type of business. It is not necessary for a foundry to have an elaborate cost system, but the more refinements that can be made to a simplified system the more accurate the cost determination will be. In illustrating a simple, basic system for smaller jobbing foundries, the author has used fictitious figures; they do not represent operations of any particular foundry.

■ Some 40 years ago a West Coast cost consultant named Hax interested several foundries in a cost system. The main theory of the system was to take the total of foundry costs exclusive of metal and coke, and divide this by the number of molder and coremaker hours worked during the period under survey. This gave the cost of a so-called mechanic-hour. To this was added the cost of metal and coke divided by the number of pounds of good castings produced to obtain metal costs.

To illustrate, go back 20 years to approximate costs of that day. Assume $300,000 was spent during one year for labor, salaries, utilities, supplies (metal and coke excepted) property taxes, repairs, maintenance, depreciation, and so forth. During that period 70,000 molder hours and 30,000 coremaker hours were worked; 300,000 divided by 100,000 hours would give a cost of $3.00 per mechanic-hour.

Assuming 3000 tons of castings were produced during this period and $120,000 total expenditure made for scrap, pig, steel, briquets, coke, then $120,000 divided by 6,000,000 pounds would equal 2¢ per pound as the cost of metal.

As an example, determine the cost of a casting weighing 75 pounds, taking 30 minutes to mold, with cores taking 10 minutes. Total time is 40 minutes or ⅔ of one hour:

⅔ of $3.00 per hour	$2.00
75 pounds of metal @ 2¢ per pound	1.50
	$3.50

Total costs exclusive of defective ratio (assume 7 per cent, would be $3.50 plus 25¢; $3.75 divided by 75 (weight of casting) would equal 5¢ per pound.

Naturally these principles of cost, while better than no system at all, left much to be desired. Refinements to this ultra basic system were needed. Competition is such today that no foundry executive should be satisfied with an overall satisfactory profit picture based upon an overprice of some castings and an underprice of others. To satisfactorily guard against this contingency . . . to protect the interests of the plant . . . to maintain a satisfactory and decent relationship between plant and customers . . . it is essential that management know costs accurately.

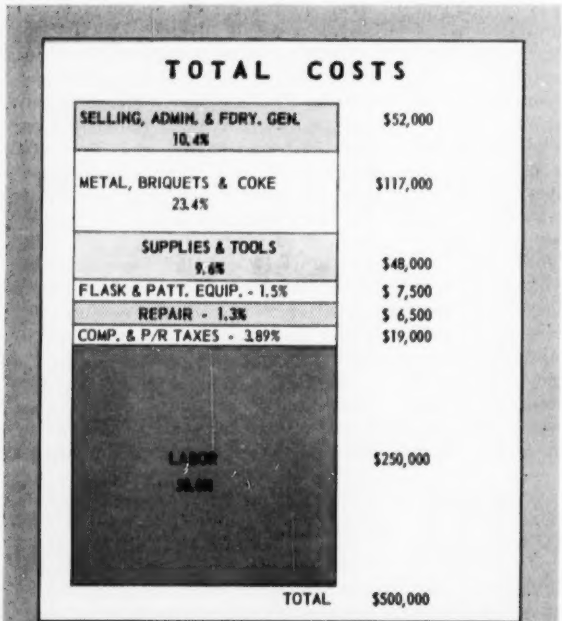


Fig. 1

Cost System Refined

The first major refinement to what is now recognized as an antiquated system, was the separation of the costs of molding and of coremaking, and to consider the cleaning department as a separate unit. Cleaning and shipping costs are still controversial and several methods are today used to account for them.

To visualize the costs confronting every foundry today—ferrous, non-ferrous, mechanized, no mechanization whatsoever, jobbing, production, small, large, medium—a graphic illustration of costs and their basic

distribution, has been developed by the author. The figures used are solely for illustration purposes; they have been arbitrarily chosen.

Assume a foundry produces 1500 tons of castings per year (3,000,000 pounds). The basic cost of production is exactly \$500,000 without the calculation of any loss ratio or insurance factor. Primarily, there are four general departments in any foundry: Mold, Core, Cleaning & Shipping, and Melting. These four departments cannot directly assume all foundry costs. Real estate and personal property taxes must be paid, depreciation of buildings and equipment must be absorbed, fire insurance must be taken care of, and certain repairs must be made to building not directly attributed to any of these four departments. Certain overall supervision, certain sales salaries and expenses must be considered.

Placing Costs

How about the gas, electricity, water? Also, the United Crusade, dues to labor negotiating agencies, clerical help to make out payrolls and the many government reports. Billings must be made and above all, certain salaries must be paid for the gathering and segregation of cost information. Where shall these costs be placed? Accepted practice, and here again the most simplified system is being suggested, is to have a catch-all account—call it Foundry General.

Figure 1 shows how the total costs of operating the foundry are distributed by type of material and service. Division of these costs into the four departments—Mold, Melt, Core, and Cleaning—is shown in Fig. 2. To calculate the molding overhead, divide the total of all other molding expenses by the direct labor (20,000 hr at \$2.25) cost and multiply by 100:

$$\frac{\$160{,}321}{\$\ 45{,}000} \times 100 = 356.27 \text{ per cent}$$

The cost of a molding hour can be calculated by adding the hourly rate to the overhead chargeable per molding dollar. Thus the cost of a molding hour is:

$$(\$2.25 \times 356.27\%) + \$2.25 = \$10.266$$

or, rounded off: \$10.27. This can be checked against the total charges to the Mold department by multiplying the cost of the molding hour by the total hours.

Cost at Cupola

In the Melt department, the cost of metal and briquets (\$100,000) divided by the weight of good castings (3,000,000) results in a metal cost of 3.33¢ per pound. Dividing the total of all Melt department costs exclusive of metal (\$49,456) by weight of good castings gives 1.65¢ per pound as the cost of melting. Total cost at the cupola spout of each pound of metal sold as castings is 4.98¢ or, for all practical purposes, 5¢.

Core costs are calculated as in the Mold department. Core overhead is:

$$\frac{\$76{,}510}{\$29{,}250} \times 100 = 261.6 \text{ per cent}$$

Cost of a coremaking hour is: (\$2.25 x 261.6%) + \$2.25 = \$8.136 or, rounded off: \$8.14. A check against the total charge obtained by multiplying this figure by the total coremaking hours (13,000) shows that the figure is sufficiently accurate for use.

Cleaning costs can be calculated in several ways:

POUND BASIS: Divide cleaning costs (\$39,463) by pounds of castings (3,000,000) to get 1.36¢ per pound.

MOLDING LABOR BASIS: This can be worked out in two ways. Figuring cleaning cost as a percentage of direct molding labor, the calculation is:

$$\frac{\$39{,}463}{\$45{,}000} \times 100 = 87.7 \text{ per cent}$$

To include this part of foundry costs in the molding hour, add molding and cleaning cost and divide by molding hours (20,000) to get a combined figure of \$12.24.

MOLD PLUS CORE LABOR: Divide cleaning cost by the total of direct molding plus direct core making. Result is 53.2 per cent.

The remainder of the foundry costs are handled in the Foundry General Account as shown in Fig. 3.

One additional cost has to be considered. It is the insurance factor or loss ratio. Some plants might use an arbitrary overall percentage, say 7½-10 per cent and figure all of their castings on this average. Others might try to add a percentage dependent upon the class of work, irrespective of the general average. This is a matter of study and judgment within each individual plant. One way or another, foundrymen must consider this factor and remember it is part of foundry operating costs.

Specific Examples

With all cost factors outlined, it is possible to consider examples of figuring costs of specific castings. In the following example, the calculations are for the casting used previously: weight, 75 lb; molding time, 30 min; core time, 10 min. Cleaning cost is on a mold labor basis, the method probably utilized most. According to the previous calculation, this is 87.7 per cent. Thus combined molding and cleaning overhead is 356.3 plus 87.7—444 per cent. The cost of producing the casting is calculated as follows:

30 minutes molding at \$2.25 per hour	\$1.125
Molding and cleaning overhead at 444%	5.00
10 minutes core time at \$2.25	0.375
Core overhead at 262%	0.98
Metal, 75 lb at 5¢	3.75
Cost of casting exclusive of loss	11.23
Consider average 10 per cent loss	1.12
Cost of casting	\$12.35

In round figures \$12.35 divided by 75 pounds equals 16½¢ per pound.

This is a recognized method of determining the production cost of a casting. Time can be saved through the use of a chart graduated in intervals of one minute, five minutes, tenths of an hour, etc., based on molding and core hour. This has previously been shown to be identical to the actual direct labor cost plus overhead percentage. Putting cleaning costs on a molding labor basis, total overhead is 444 per cent and molding cost is \$12.24 per hour. Using this figure, Table 1, based on 10 minute intervals, was prepared. A table listing metal-at-spout costs at pound intervals is also helpful in speeding cost calculations.

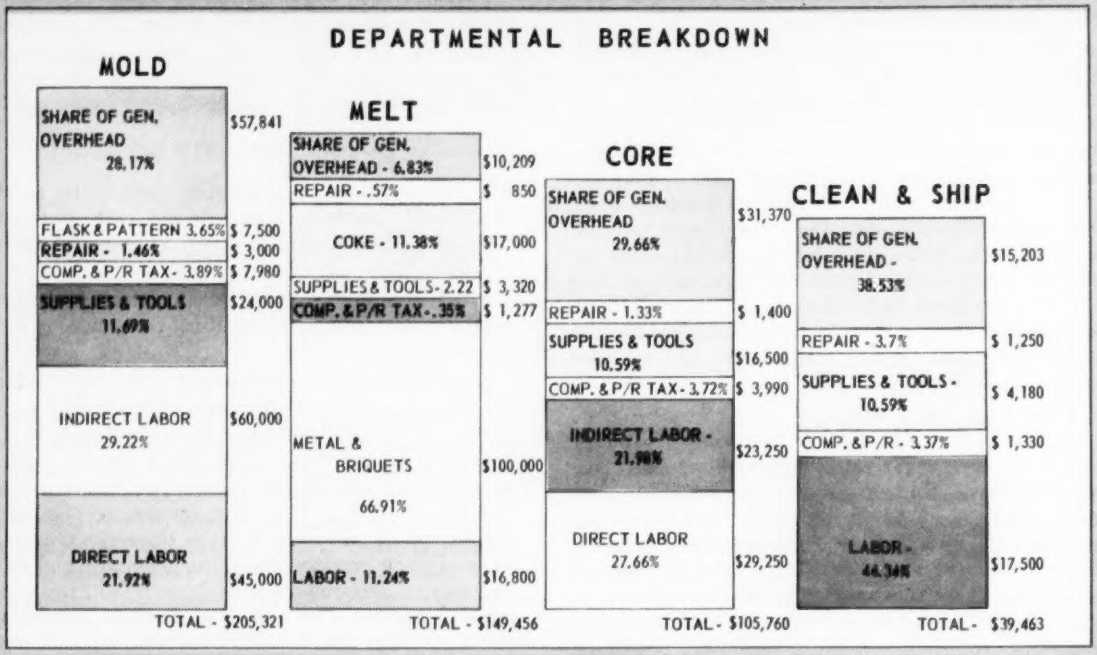


Fig. 2

The above calculation, worked out from Table 1 is simplified to:

Molding, 30 min.	$6.12
Core, 10 min.	1.36
Metal, 75 lb	3.75
	11.23
Loss, 10 per cent	1.12
Total cost	$12.35

Now consider the calculation as made by the first method outlined. Costs exclusive of metal and coke are $383,000 and molder and coremaker hours total 33,000. Cost of a mechanic-hour is then $11.60. Cost of metal and coke ($117,000) divided by pounds of castings produced (3,000,000) gives 3.9¢ per pound. To calculate:

2/3 of a mechanic hour	$7.73
75 lb of metal at 3.9¢	2.93
	$10.66
Loss, 10 per cent	1.07
	$11.73
Cost per pound	15 2/3¢

Note that the cost of the casting in this less-accurate basis is significantly lower.

Now assume that the same casting takes 30 mintues of core time and 10 minutes molding time instead of the reverse as in the original example. Under the advanced method of calculation, the cost would be:

Core	$4.07
Mold	2.04
Metal	3.75
	$9.86
Loss	0.99
Cost	$10.85

Under the mechanic-hour system, the cost would still be the same as before event though the actual production cost, as shown immediately above, is lower because the method of production changed.

Other Costs

Although almost all costs have been considered, there are still several costs that should be figured directly as costs on each job. These are:

1. Delivery Charges. The above analyses give cost FOB foundry. Any delivery costs are charged directly to the job.

2. Special work over and above those costs previously outlined, such as special pattern changes, annealing, special rigging, addition of special alloys, etc. These are costed directly to the job on which costs are being determined.

The breakdowns and methods described are, in the author's opinion, basic. They are the first steps that all foundries should adopt if they have not already done so. Many foundry executives have refined their costing procedures to high school and college status, while this article discusses, so to speak, primary school costing.

Labor and Expenses

The main difference between the method described and a more exacting method is a closer analysis of indirect labor and expenses. The article puts approximately 20 per cent of the overall costs under indirect labor. Think how much closer it would be to true costs, if certain of these costs were charged against the operations of the several production units.

For instance, assume the cost of a sand system serving 10 molders on eight squeezers and two rollovers is $40.00 per day, and that the squeezers used 60 per cent of the sand produced by volume. Then:

	Rollover	Squeezer
Hours direct labor	16	64
Direct payroll cost at $2.25 per hour	$36	$144

Under an average basis for both machines, the overhead would be $40 x 100 ÷ $180 or 22.2 per cent.

Consider how much more true the costs would be if 40 per cent of the cost of unit and sand ($16) were divided by the rollover payroll of $36. This would result in an overhead of 44.4 per cent. On the squeezers, 60 per cent of the unit cost ($24) would be divided by the squeezer payroll of $144 resulting in an overhead of 16 2/3 per cent.

This could, if competition was sharper on costs, result in the fictitious foundry in the example having plenty of rollover business while losing out on the squeezer business. To refine its cost system, the foundry would remove from overall costs those directly chargeable to the sand system and consider it as a separate operation. All labor costs, depreciation, supplies, proper share of insurance and taxes on equipment, repairs, maintenance and the like would be overall costs of this unit or department. It would give truer costs as well as withdrawing those charges from the overall expense picture and making the overhead percentage more true.

TABLE 1—MOLDING, CLEANING, AND CORE COSTS

Time	MOLD & CLEAN	CORE
10 min	$2.04	$1.36
20 min	4.08	2.71
30 min	6.12	4.07
40 min	8.16	5.43
50 min	10.20	6.79
1 hour	12.24	8.14

Further breakdown into other units served by say a sandslinger—two or more floors served by a piece of special equipment—in fact, a separate cost for each molding floor could be determined by a closer analysis of each factor entering into the costs of each individual station. In many foundries today this is being accurately determined. There is no question but that a separation of direct labor from all other foundry labor in different foundry operations—the localizing of all indirect labor and expenses to its proper operating unit, leaving a minimum of general overhead items to be pro-rated—will give the truest.

Likewise in core departments, breakdowns between blower, bench, and machine are being more accurately determined. Examples in this article used an average overhead, the same for each. Yet the capital expenditure and depreciation on a blower, repairs, quantity of materials consumed in comparsion with, say, a bench core clearly shows that two different overhead percentages should be used. Wherever possible today core indirect labor together with the cost of materials, fuel, and related costs should be allocated on a weight basis of core.

Foundrymen should remember that more minutely they can separate their costs, the closer they will come to knowing their true costs.

Another refinement in costing procedure is the closer determination of actual metal costs dependent upon variations of yield. The method previously described for determination of metal costs provides for an average yield. It does not take into account variations in yield.

In many of the larger shops thoughts have been directed toward this for years and yield tables are set up to determine more closely the amount of metal used in a mold so that calculations may be on a more scientific and accurate basis.

In the original problem, metal costs were 3.33¢ per pound and conversion costs 1.65¢ per pound. This was average cost per pound of good castings produced. Due to the fact that in some cases the pounds of good castings produced per 100 pounds of charged metal might be high, and in others due to heavy risers, gates, etc., be low, it should be determined how much actual metal is necessary to pour any casting. Cost of metal remains static while conversion costs fluctuate due to amount of metal needed.

For example, the author has set up a yield table using costs from the original problem (Table 2). To set up such a table, assume that the shop yield is 59 per cent, which is arrived at by dividing the pounds of good castings produced (3,000,000) by total amount of cold metal charged (5,100,000 pounds). Actually the mold yield will be somewhat higher due to oxida-

TABLE 2—YIELD TABLE FOR CALCULATING METAL COST

			Melting Costs			
Shop Yield	Mold Yield	Lb Cold Metal for 100 lb Castings	Cost to Melt 100 lb Iron	Cost to Melt 100 lb Good Castings	Metal Cost for 100 lb Good Castings	Melted Metal Cost for 100 lb Good Castings
27	30	370	$.97	$3.59	$3.33	$6.92
32	35	313	.97	3.04	3.33	6.37
36	40	278	.97	2.70	3.33	6.03
41	45	244	.97	2.37	3.33	5.70
45	50	222	.97	2.15	3.33	5.48
50	55	200	.97	1.94	3.33	5.27
55	60	184	.97	1.78	3.33	5.11
59	65	169	.97	1.64	3.33	4.97
64	70	156	.97	1.51	3.33	4.84
68	75	147	.97	1.43	3.33	4.76
73	80	137	.97	1.33	3.33	4.66

FOUNDRY GENERAL - Non-Apportioned Expenses

		MOLD	CORE	MELT	CLEAN
UTILITIES 9.60%	$11,000	$ 3,500	$ 2,700	$ 800	$ 4,000
		(Based on direct usage in each department)			
EQUIP. DEPRECIATION 7.85%	9,000	3,000	3,000	1,000	2,000
		(Based on value of equipment in each department)			
FIRE INSURANCE - 2.88%	3,300				
TAXES-R.E. & P.P. - 3.84%	4,400	4,850	2,425	970	1,455
BLDG. DEPRECIATION - 7.85%	2,000	(Based on floor space)			
REPAIRS - 6.98%	8,000				
ADMIN. & SELLING 12.47%	14,300				
SALARIES & SALES ADMIN. & CLERICAL 24.60%	28,200	46,491	23,245	7,439	7,748
		(Based on payroll)			
P/R TAXES & COMP. INS. - 3.86%	4,423				
FOUNDRY GENERAL LABOR & SUPERVISION 26.17%	30,000				
TOTAL	$114,623	$57,841	$31,370	$10,209	$15,203

Fig. 3

tion, overruns, spills, grinding, etc—a suggested percentage used being 10 per cent—so that if shop yield is 59 per cent, mold yield would be 65 per cent.

The pounds of metal charged per 100 lb of good castings is obtained by dividing 100 by the shop yield (59 per cent). Result is 169 lb. Cost to melt 100 lb of cold metal is the total costs of the department exclusive of metal ($49,456) multiplied by 100 and divided by total weight of metal charged—97¢. Cost of melting 100 lb of good castings is the cost of melting the number of pounds needed to get the 100 lb multiplied by cost of conversion. Cost of metal for 100 lb of good castings is the actual cost of 100 lb of metal. Melted metal cost per 100 lb of good castings—the figure sought for casting cost calculations—is the metal cost plus the conversion cost.

AFS Safety and Health Symposium Now Available

In order to help "Make the Foundry a Good Place in Which to Work," AFS has printed a symposium on the conference held at the University of Illinois, Feb. 17-19, 1953.

Recognized foundry experts participated in this meeting, and discussed material of considerable value to supervisory and management personnel. The symposium covers various foundry safety, health and air pollution problems. It may be secured from AFS national headquarters for $5 per copy.

$12,000 Steel Research Fund Made Available to AFS

Announcement has been made that American Steel Foundries, Inc., of Chicago, has created a $12,000 research fund that will be made available to American Foundrymen's Society. The Fund is designated for advanced research that will benefit the entire steel castings industry, and is to be used for work performed at Armour Research Foundation, Illinois Institute of Technology, Chicago.

A Steering Committee to administer the Fund has been appointed. It consists of Dr. Max Hansen, Manager, Metals Research Department, Armour Research Foundation, Chairman; L. L. Clark, in charge Foundry Research, Armour Research Foundation; and H. J. Heine, Assistant Technical Director, American Foundrymen's Society, as Staff Liaison.

An exploratory and organizational meeting of the Steering Committee has been held. At that time, suggestions from both the Executive Committee and the Research Committee of the Steel Division were taken under advisement. Further meetings will be held to consider specific projects and other details of the administration of the Fund.

The Committee will endeavor to prepare a program of broad interest and one that will result in maximum benefit to the entire steel foundry industry. As projects for research are decided upon, they will be publicized and the nature of the results will be properly reported by the Steering Committee.

Past-Pres. I. R. Wagner . . . Nominating Comm. head

Nominating Committee Named by AFS Board

THE 1953-54 AFS Nominating Committee was appointed by the Board of Directors of the Society in its meeting of July 23, 1953. This Committee is charged with the responsibility of selecting candidates for the various offices and directorships, the list to be reported at least three months prior to the annual Business Meeting. Consisting of at least seven members, representing various chapters and technical divisions, and the two immediate Past Presidents, Committee members are chosen from among nominees submitted by the chapters. The new panel comprises the following:

Past President I. R. Wagner (1952-53), Director, Electric Steel Castings Co., Indianapolis, Ind., Chairman.

Past President Walter L. Seelbach (1951-52), President, Superior Foundry Inc., Cleveland.

E. C. Austin, Jr., Vice-President & General Manager, National Aluminum & Brass Foundry, Inc., Independence, Mo. (Representing Mo-Kan Chapter, Brass & Bronze and Light Metals).

R. E. Dickison, Asst. Mgr., Brass Foundry Co., Peoria, Ill. (Representing Central Illinois Chapter, Brass & Bronze).

L. C. Gleason, Foundry Supt., Gleason Works, Rochester, N. Y., (Representing Rochester Chapter, Gray Iron).

G. J. Grott, Research Metallurgist, Unitcast Corp., Toledo, Ohio (Representing Toledo Chapter, Steel).

L. O. Hofstetter, President, Brumley-Donaldson Co., Los Angeles (Representing Southern California Chapter, Supplies).

L. W. Williamson, Foundry Supt., Minneapolis-Moline Power Implement Co., Hopkins, Minn. (Representing Twin City Chapter, Gray Iron).

Candidates Reported

Article X of the AFS By-Laws provides that candidates for office who are nominated by the Committee shall be reported, either by mail or in the AMERICAN FOUNDRYMAN at least 60 days before the annual Business Meeting. Section 9 of Article X also stipulates that, after the report of the Committee has been published, and up to 45 days prior to the Business Meeting, additional nominations may be made by written petition filed with the Secretary, and signed by 35 members in good standing.

Malleable Iron Booklet Available

A NEWLY published, profusely illustrated booklet in color is being distributed by Malleable Founders' Society to high school and vocational school students, engineering school enrollees, and at conventions and exhibits.

The brochure tells the story of malleable iron in the castings industry, listing historical material, advantages of its use, and application in industry. Principally, it is designed to present the malleable iron foundry field with the purpose of interesting young men in seeking a career in that type of casting operation.

The booklet is available from member companies of the society, or by writing Malleable Founders' Society, Union Commerce Building, Cleveland 14, Ohio. There is no charge.

Noise Abatement Symposium Scheduled

A National Noise Abatement Symposium has been announced for October 23 and 24, at Armour Research Foundation, Illinois Institute of Technology, Chicago.

The symposium is designed to present a comprehensive picture of nation-wide activities in the field of noise, and will feature talks by leading authorities on outdoor noise problems. One session will be devoted to industrial noise hazards.

Program committee chairman, George L. Bonvallet, is expecting more than 300 scientists, engineers, doctors, architects, manufacturers, and civic authorities to attend the sessions.

The meeting is being sponsored jointly by: National Noise Abatement Council, Acoustical Materials Association, American Society of Safety Engineers, Acoustical Society of America, American Industrial Hygiene Association, American Society of Planning Officials, Council on Industrial Health, American Medical Association, American Institute of Architects, and Armour Research Foundation.

Of particular interest to foundrymen will be the speeches on industrial noise, noise legislation, and the combatting of noise effects.

Fracture Test For Determining Melt Quality of 85-5-5-5 Red Brass

Variations in melting practice significantly affect melt quality in commercial practice. Seeking a satisfactory procedure for determining melt quality, the Research Committee of the AFS Brass and Bronze Division has sponsored research on the fracture test. The Committee reports here on its findings.

■ The relationship of melting conditions, particularly the furnace atmosphere, to melt quality* has long been recognized. Qualitative effects of variations in melting practice on melt quality have been established in many commercial foundries and some type of procedure for checking such difference has been set up, but no completely satisfactory method for determining melt quality has been advanced. The Research Committee of the Brass & Bronze Division of the American Foundrymen's Society sensing the desirability of establishing, if possible, a method or procedure that might be generally acceptable, sponsored a research project to study the fracture test as a possible indicator of melt quality.

The investigation has shown that the fracture test may be used to predict melt quality with a reasonable degree of accuracy. Correlation between fracture characteristics of the chill block and separately cast test bars have been carried out on approximately 100 separate heats. The melt quality of these heats were classified into three groups according to the mechanical properties of the separately cast test bars, as follows:

	(Tensile Strength)	(Per Cent Elongation)
High Quality	over 37,000	over 30.0
Intermediate	35,000 to 37,000	25.0 to 30.0
Low Quality	under 35,000	under 25.0

Interpretation of the fractures of the chill blocks as to color, texture, columnarity, and extent of mottled appearance gave good correlation with the above three classifications. However, the extent to which the use of the test will prove successful will be dependent to an appreciable degree on the personal factor. Only through observation of numerous fractures will foundrymen become familiar with the interpretation of the chill block fractures, as they are used in fracture tests.

After the presentation of the 1952 Progress Report, several written discussions were submitted stating that the test had been tried by commercial foundries. A combined report from three prominent brass foundries in Great Britain stated: "As a result of the tests made by the three foundries, it is apparent that the claims made for the fracture test by the American Foundrymen's Society appear to be justified in the case of 85-5-5-5 gun metal gassed with hydrogen. The fracture gives a fairly sensitive indication of the amount of gas contained in the metal and can be correlated with the percentage porosity and the mechanical properties."

A Very Successful Tool

The foundry metallurgist from an East Coast jobbing shop stated: "The fracture block test as developed by . . . the Brass and Bronze Division of the American Foundrymen's Society has proved itself, in our experience at least, a very successful tool for quality control. It has the advantage of being rapid yet simple and inexpensive. A test can be run in 3 to 4 minutes without trouble. . . After some practice, the various items of the fracture such as texture, color shades, and degree of mottle can be correlated so that you will have a very good idea of how good, or bad, a particular heat is."

Many other foundrymen have commented on the merits of the test and all agree that fracture testing for determining melt quality or other types of defects has become one of the best control tools in the foundry. The main purpose of the chill block fracture test is to determine the quality of a heat of metal before pouring it into expensive molds or into castings that require metal of high quality. It is uneconomical to pour metal of low or questionable quality into a casting that has required many hours of molding time or into a casting that is required to be pressure tight at a high hydrostatic pressure and then find them to be

continued on page 71

*Melt quality is defined as the gas content of the metal, i.e. low quality refers to metal of high gas content and metal of high quality has low gas content.

Procedure For Producing Red Brass Fracture Test Blocks

The following is the recommended procedure for making a fracture test for determining the melt quality of a heat of 85-5-5-5 red brass in approximately three to five minutes.

1. Set up chill block core and chill plate assembly as shown below. It is essential that the surface of the chill plate be clean and dry. Use an oxy-acetylene torch, first to heat the plate and then to blacken it. A bleed slot is provided in the core to lower the level of the metal in the mold and prevent chilling the upper face against the pouring basin. Any commercial core mix may be used with reasonable safety.
2. Superheat the melt to its final peak temperature, making additions for deoxidation and zinc loss according to standard shop practice.
3. Using a hot No. 2 crucible, tap the full volume—approximately four pounds.
4. Immediately pour the chill block, making certain that the pouring temperature is between 2200 and 2000 F. The pouring basin *must* be kept full to insure a rapid, uniform rate of pouring.
5. Remove the pouring basin immediately after pouring and allow the chill block to cool until the top has solidified—1 to $1\frac{1}{2}$ minutes. Then shake out and water quench the block.
6. Fracture the chill block, examine the fresh fracture, and check for melt quality.

Interpretation of Fractures

The fractures of the chill blocks should be examined for each of several characteristics which are reliable indications of melt quality. The fractured surfaces (see illustration) consist of several distinct areas, all of which have some significance in evaluating melt quality.

1. Depth of Blue-Gray Structure

The most reliable index of melt quality is the depth of fine blue-gray structure which originates at the chilled face and extends upward to the air cooled face. High-quality melts show 2 in. or more; intermediate-quality melts show $1\frac{1}{2}$ to 2 in.; low-quality melts show less than $1\frac{1}{2}$ in.

2. Texture of Fracture

Examination of the overall texture of the fracture provides a reliable indication of melt quality. If generally fine-grained and smooth, it indicates high melt quality. A course and granular fracture with an overall rough appearance indicates low melt quality.

3. Color of Fracture

The color of a fresh 85-5-5-5 fracture provides a reliable index of melt quality. A definite blue color indicates high quality, a reddish or copper color indicates low quality.

4. Granular Area above Blue-Gray

The extent of the rather course granular area above the blue-gray area in the chill block is an indication of melt quality. In metal of high quality, this area is small, finely granular and flecked with yellow in an otherwise reddish fracture. In metal of low quality, this area is larger, coarser, more granular and more mottled in appearance.

5. Columnarity

A columnar pattern, which originates at the chilled face and extends upward in the blue-gray area, may be used as an indication of melt quality. Metal of high quality shows $\frac{3}{4}$ in. or more columnar pattern. Metal of intermediate quality shows $\frac{1}{2}$ to $\frac{3}{4}$ in. columnar pattern. Metal of low quality shows less than $\frac{1}{2}$ in. columnar pattern.

Precautions Necessary in Interpreting Chill Block Fractures

Each fractured chill block should be examined for indications of improper production practice which might provide false fracture characteristics. Several divergences from the specified practice exert a strong influence on the fracture appearance:

1. Pouring Temperature

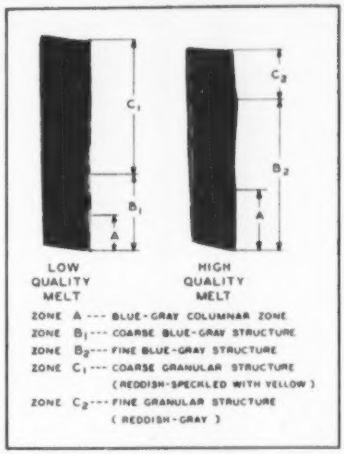
When either the absence of columnarity or the presence of spongy brown areas is encountered, the fracture should be viewed with skepticism since these indicate too low a pouring temperature.

2. Gas Holes

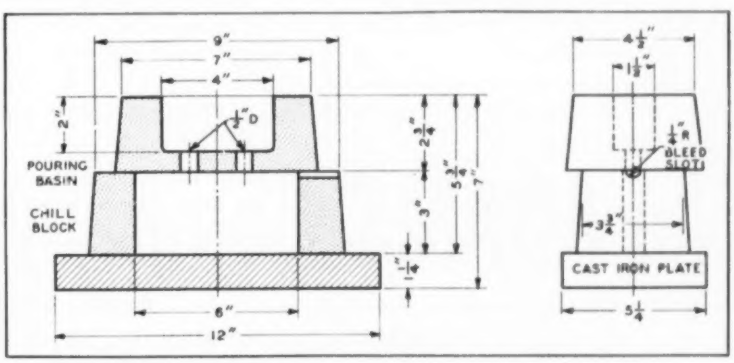
If the block shows evidence of shiny, rounded holes on or near the surface, it is probably due to gas pick-up from the chill plate.

3. High Quenching Temperature

Quenching before complete solidification may show fine fractures in the upper face where under standard conditions they might have been granular or mottled. Discolored quenching cracks may also occur; these usually coincide with the actual columnar zone and should make no significant change in quality interpretation.



Chill block fractures, showing melt quality characteristics.



Chill Block Core Assembly for Fracture Block—6 in. x 3 in. x $\frac{3}{4}$ in.

Fracture Test For Red Brass

continued from page 68

defective after machining. However, if the heat of metal is known to be of low quality, it can be: poured into castings not requiring the highest quality metal in order to be satisfactory; treated in some manner to improve its quality, i.e. nitrogen flushing; or poured into ingot rather than waste the molding time or subsequent expensive machining operations.

More the Test Can Do

Several foundrymen operating large production shops that make relatively small castings and pour almost continuously, have objected to the test because they have felt they could not afford to hold a heat of metal while waiting for the results of the fracture test. Not only can the test be used for determining melt quality prior to pouring, but also for the following:

1. To make daily checks on the combustion control on each melting furnace. If the fracture block indicates faulty operation of the furnaces, the fuel and air ratio can be corrected immediately.
2. To check the ability of the various melters to maintain the required furnace atmospheres on furnaces operating with manual controls.
3. To determine whether a particular lot of critical castings should be sent to the machine shop for machining. If the fracture of the test block indicates that the heat is of low or questionable quality, the castings could be remelted rather than discover after expensive machining operations that the castings are defective due to low quality metal.

The procedure for making the chill block tests and the various criteria for their interpretation are listed on page 69. It is hoped that the page will be removed and displayed in a prominent location in the melt room for the use of the operating personnel.

The Research Committee requests that any foundry using the foregoing or any other form of fracture test for determining the melt quality of 85-5-5-5 red brass or any other copper-base casting alloy report its findings to the Technical Director, American Foundrymen's Society, 616 S. Michigan, Chicago 5, Ill. Comments from the commercial foundries using fracture tests for determining melt quality will be of value to the Research Committee in making an estimate of the general acceptance of the procedure evolved by the research project.

References

The research project was undertaken by the Departments of Chemical & Metallurgical Engineering and Production Engineering at the University of Michigan in 1948. The preliminary work embodied in the first progress report, *"Melt Quality and Fracture Characteristics of 85-5-5-5 Red Brass"*, was presented at the AFS Annual Convention in 1949 and was published in the AFS TRANSACTIONS, vol. 57, pp. 433-449 (1949). Specifications and procedures for making a rapid melt quality fracture test were presented in the second progress report entitled *"Melt Quality and Fracture Characteristics of 85-5-5-5 Red Brass"* at the Convention in 1950 and were published in the TRANSACTIONS, vol. 58, pp. 122-132 (1950). Also incorporated in this progress report are several fine photographs in color of the fractures obtained from heats of various melt qualities.

The specifications for the fracture test were also issued in a revised and enlarged circular under the title "Instructions for the Production of Chilled Blocks for 85-5-5-5 Red Brass" and were distributed by the National Office of the American Foundrymen's Society in June 1950. Further work on the chill block test for 85-5-5-5 red brass and its extension to 88-8-0-4 tin bronze was presented in the progress report entitled *"Melt Quality and Fracture Characteristics of 85-5-5-5 Red Brass and 88-8-4 Bronze"* at the annual convention in 1951 and published in the TRANSACTIONS, vol. 59, pp. 67-78 (1951). Extension of the work to other alloys, namely 81-3-7-9 leaded red brass and 83-7-7-3 high lead tin bronze was carried out and presented as a progress report at the annual convention in 1952. (This report has not been published to date.)

F.E.M.A. Schedules Annual Meeting

THE Foundry Equipment Manufacturers Association will hold its 35th annual meeting at the Greenbrier, White Sulphur Springs, W. Va., from October 15 to 17, 1953.

The three-day session is the high point of the Association's yearly activities and, this year, will feature a speech by William J. Grede, president, Grede Foundries, Inc., Milwaukee, past president of National Association of Manufacturers, and a recipient of an Honorary Life Membership in AFS at the 1953 Convention. Mr. Grede will speak at the F.E.M.A. banquet on the evening of Friday, October 16, where he will discuss his observations made on a recent trip through various European countries.

Round table discussions will be held on subjects of major interest to the Association members. They will include the following major components of foundry equipment: molding, dust and fume, flask, blast cleaning and tumbling, furnaces and accessories, and materials handling and processing.

Equipment Outlook

Since F.E.M.A. has recently begun a new statistical program designed to provide better information on the various trends in shipments and new orders for foundry equipment, a discussion round table will be held on "The Outlook for Foundry Equipment." The purpose is to determine how the industry can provide the best possible service to its customers.

One of the most interesting features of the annual meeting will be a report on the International Foundry Congress to be held in Paris in September. Two of the Association officers will report their impressions of the European sessions: F.E.M.A. President, Claude B. Schneible, president, Claude B. Schneible Co., Detroit; and the Association Vice-President, W. B. Wallis, president, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, Pa.

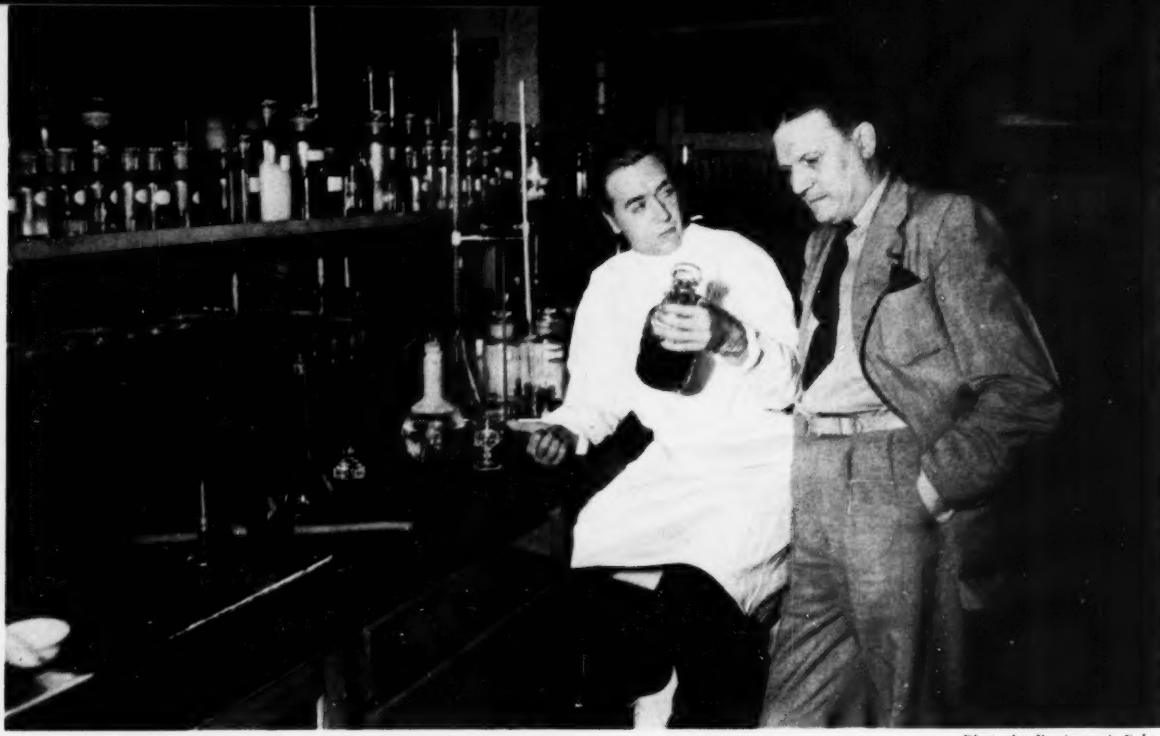


Photo by Kaufman & Fabry

Quantitative Determination of Tungsten in Titanium

MAURICE CODELL / *Pitman-Dunn Laboratories Department, Frankford Arsenal, Philadelphia, Pa.*

Tungsten may be quantitatively determined in titanium metal using alpha benzoin oxime as the reagent, followed by digestion of the precipitate with ammonium hydroxide to dissolve tungsten. After filtration, ammonia is expelled by evaporation, and tungsten is finally precipitated as the oxide with the aid of cinchonine solution after digestion with nitric and perchloric acids. A small quantity of molybdenum is added to carry down the last traces of tungsten during the alpha benzoin oxime precipitation. Any molybdenum which is carried down during the final tungstic oxide precipitation is determined colorimetrically and deducted from the final weight.

■ The method commonly employed for determining tungsten in steel, precipitation as tungstic oxide, is inapplicable in the presence of a high concentration of titanium. The conditions required to determine tungsten by acid digestion cause hydrolysis of titanium.

Knowles[1] prescribed a method for the determination of tungsten in steel using alpha benzoin oxime as the reagent. According to "Chemists, U. S. Steel Corp."[2] this method is used as a means of checking results for tungsten when present in small percentages.

The principles of this method may be applied to the determination of tungsten in titanium provided precautions are taken to prevent hydrolysis and to remove the small quantity of titanium which is always carried down with the alpha benzoin oxime precipitate. This method is satisfactory for determining tungsten in titanium metal when the tungsten content is in the range 0.05 to 0.50 per cent.

Titanium is dissolved in sulphuric and hydrofluoric acids. Tungsten is precipitated with alpha benzoin oxime from a cold solution to which has been added a small quantity of a soluble molybdenum salt, to aid in carrying down the last traces of tungsten in solution. Bromine water is added as a precaution against the reduction of tungsten. The alpha benzoin oxime precipitate is digested with ammonium hydroxide in order to separate titanium and any of the other contaminants which may have been carried down during the precipitation. Upon filtration, all the tungsten is in the filtrate and the ammonium hydroxide insolubles, including most of the alpha benzoin oxime reagent, remain on the filter paper.

The solution is boiled to expel ammonia. Nitric acid and a small quantity of perchloric acid are added and the solution is heated to strong fumes of perchloric acid. Perchloric acid is kept to a minimum as this acid interferes with the quantitative precipitation of tungstic oxide.[3] The solution is diluted and cinchonine

and hydrochloric acid are added, and the solution is digested below the boiling point for a half hour. The solution is permitted to stand at least two hours at room temperature before filtering. After filtration the precipitate is ignited at a low heat in order to prevent the loss of tungstic oxide by volatilization. The precipitate is treated with hydrofluoric acid in order to volatilize silica. After additional heating at low temperature, the precipitate is weighed as tungstic oxide, plus a small quantity of molybdic oxide.

Molybdenum is determined by fusing the precipitate with sodium carbonate, dissolving the fused mixture in water, neutralizing with sulphuric acid, and treating the solution with sodium thiocyanate and stannous chloride. The molybdenum complex is then extracted with butyl acetate and determined colorimetrically. The quantity of molybdic oxide determined is subtracted from the original weight of the precipitate.

Reagents and Apparatus

Alpha Benzoin Oxime Solution: Dissolve 10 grams of alpha benzoin oxime in 500 ml of warm 95 per cent ethyl alcohol and filter through a medium sintered glass filtering crucible.

Alpha Benzoin Oxime Wash Solution: Add 10 ml of sulphuric acid (1:3) to water and dilute to one liter. Cool below 10 C and just before using, add 50 ml of alpha benzoin oxime solution and mix.

Molybdenum Solution: Dissolve 3 grams of sodium molybdate in one liter of water.

Potassium Thiocyanate Solution: Dissolve 50 grams of potassium thiocyanate in one liter of distilled water.

Stannous Chloride Solution: Add 120 ml of concentrated hydrochloric acid to 150 grams of stannous chloride and heat to dissolve. Dilute to one liter with distilled water and add several chips of metallic tin.

Butyl Acetate Reagent: To 120 ml of butyl acetate in a separatory funnel add 10 ml of potassium thiocyanate solution and 30 ml of stannous chloride solution. Shake, let stand until the layers separate, then draw off and discard the aqueous layer.

Cinchonine Solution: Dissolve 125 grams of cinchonine in a mixture of 500 ml of concentrated hydrochloric acid and 500 ml of water.

Cinchonine Wash Solution: Dilute 30 ml of cinchonine solution to one liter.

Procedure

To one gram of fine titanium drillings in a 250-ml beaker, add 40 ml of sulfuric acid (1:3) and 2 ml of hydrofluoric acid (48 per cent). If the tungsten content is greater than 0.5 per cent, use a proportionately smaller sample. If less than 0.7 per cent molybdenum is present in the titanium metal, add 5 ml of the molybdenum solution. Dilute to 150 ml and heat to dissolve. When solution is complete, add nitric acid (1:3) dropwise until the titanium has been oxidized as signified by the discharge of the green color. Add 5 drops in excess and boil for two minutes.

Cool the solution and all reagents used in the alpha benzoin oxime precipitation below 10 C. The beaker containing the precipitate should be maintained in an ice bath during the course of filtration. Add 10 ml of alpha benzoin oxime solution while stirring vigorously. Add 10 ml of saturated bromine water and stir intermittently for 5 minutes. Add 5 ml more of alpha benzoin oxime solution. Stir vigorously and filter immediately through a No. 40 Whatman filter paper or equivalent. Maximum rate of filtration should be assured by maintaining a full column of liquid in the funnel stem during filtration. Wash thoroughly with the cooled wash solution. Transfer the paper and precipitate to the original beaker. Add 50 ml of ammonium hydroxide (1:1). Boil for 5 minutes. Care must be exercised to prevent loss by frothing. Filter through a No. 40 Whatman filter paper, and wash thoroughly with hot water. Evaporate the solution to approximately 25 ml to expel all the ammonia.

Add 30 ml of nitric acid (1:3) and 5 ml of perchloric acid (70 per cent), and heat to strong fumes. Let fume for several minutes. Cool, dilute to 75 ml. Add 5 ml of hydrochloric acid (1:1). Add 5 ml of cinchonine solution. Digest below the boiling point for a half hour. Let stand at room temperature for two hours and filter through a No. 42 Whatman filter paper. Wash with cinchonine wash solution. Dry and char the paper at a very low heat over a gas flame. Ignite in a muffle furnace at 600 C. Cool and add 3 ml of hydrofluoric acid and take to dryness on an air bath. Heat for 10 minutes at 600 C in a muffle furnace. Cool and weigh as impure tungstic oxide.

Correction for Molybdenum

To determine the amount of molybdic oxide contained in the tungstic oxide, fuse the residue with one gram of sodium carbonate using the lowest heat required to effect fusion. Cool and dissolve in a 100 ml beaker containing 25 ml of distilled water. Acidify with sulphuric acid (1:3) and heat to boiling to expel carbon dioxide. Transfer the solution to a 150-ml separatory funnel. Add to the beaker 5 ml of potassium thiocyanate solution and transfer it to the funnel. Add 10 ml of stannous chloride solution to the beaker and transfer it to the funnel. Shake the solution and add 20 ml of butyl acetate which has been previously saturated with potassium thiocyanate and stannous chloride solutions to the beaker and transfer it to the funnel. Shake thoroughly. Let stand until a clear separation is obtained.

Draw off and discard the acid layer. Add 5 ml of potassium thiocyanate and 15 ml of stannous chloride solutions to the funnel, shake well, and let stand until the layers separate and draw off the aqueous layer. Transfer the solution in the funnel to a 100-ml volumetric flask by pouring the solution from the top of the funnel. Do not rinse the funnel. Fill the flask to the mark using prepared butyl acetate reagent. Transfer a suitable portion of the solution to an absorption cell and measure the transmittance. Estimate the concentration of molybdic oxide from a calibration curve which is prepared by measuring the transmittance of known concentrations of molybdenum treated in the same manner.

Results

The results listed below indicate the accuracy of the method. Tungsten was added to the titanium as sodium tungstate. One gram of titanium sponge was used in

each determination. No tungsten was found in titanium sponge when blanks were run by this procedure.

Tungsten Added, %	Tungsten Found, %	Standard Deviation, %	Number of Determinations
0.05	0.052	0.0087	4
0.10	0.11	0.003	9
0.20	0.20	0.005	6
0.30	0.30	0.007	9
0.40	0.39	0.009	9
0.50	0.49	0.010	9

Discussion

The addition of hydrofluoric acid not only aids greatly in affecting solution of titanium in sulphuric acid but prevents the formation of insoluble titanium dioxide around the sides of the beaker and on the watch glass. While it is known that hydrofluoric acid forms a soluble complex with tungsten, this does not prevent its precipitation by alpha benzoin oxime. However, quantities of hydrofluoric acid much in excess of 2 ml lead to low results. The small quantity of hydrofluoric acid used in this determination attacks the glass beaker slightly. The use of the beaker is not impaired and there is no effect upon the results.

Precipitation with alpha benzoin oxime is made from a strongly acid soluton. However, precipitation from a hydrochloric acid solution produced low results.

Somewhat low results were experienced when the alpha benzoin oxime precipitate was not filtered immediately after the final addition to the alpha benzoin oxime reagent. This filtration must proceed rapidly and it is necessary to maintain a full column of liquid in the funnel stem during filtration.

Time did not permit a more comprehensive study of this procedure. There is a definite need for further study of several factors involved in this method. The application of this method to various alloys of titanium will undoubtedly necessitate additional steps in determining impurities remaining in the final precipitate.

Acknowledgment

The author wishes to acknowledge with appreciation the assistance of William R. Myers and James J. Mikula, who performed the analyses included in this report.

References

1. H. B. Knowles, *J. Research National Bureau of Standards*, vol. 9, p. 1 (1932).

2. Chemists, U. S. Steel Corp., *Sampling and Analysis of Carbon and Alloy Steels* (1938) p. 238. Reinhold Publishing Corp., New York.

3. D. A. Lambie, *Analyst*, vol. 64 (1939).

AFS Makes Educational Contribution

As a result of action taken at the July 24, 1953 annual meeting of the AFS Board of Directors, $100 has been contributed by the Society to the Foundry Educational Foundation. American Foundrymen's Society works closely with F.E.F. on matters pertaining to college level education within the fields of metallurgy and other areas associated directly with metals casting.

Scholarship Fund Announced

Announcement was recently made by Cleve H. Pomeroy, president, National Malleable and Steel Castings Co., Cleveland, that his company has established a $3,000 scholarship fund at six educational institutions.

These scholarships are the beginning of a company-named scholarship program to be arranged in cooperation with the Foundry Educational Foundation, which organization has been developing a nationwide program over the past six years on behalf of the foundry industry.

Deserving Students

The program is designed to assist deserving students interested in the foundry industry, and will ultimately help provide a larger number of college graduates trained in the engineering sciences and in business administration for future executive and engineering positions.

The scholarship funds are for $500 each at Western Reserve University and Case Institute of Technology, both in Cleveland; Rose Polytechnic Institute, Terre Haute, Ind.; Carnegie Institute of Technology, Pittsburgh, Pa.; Purdue University, Lafayette, Ind.; and Illinois Institute of Technology, Chicago. They will be awarded to students majoring in mechanical, metallurgical, industrial, and chemical engineering at the technical schools, and for business administration at Western Reserve University.

All selections will be made by the scholarship committees of the several schools. The program is part of National Malleable's observation of its 85th year in business.

Dr. Erich Hugo Dies in Germany

The recent death of Dr. Erich Hugo closed off a long and distinguished career in metallurgy and the foundry industry.

Dr. Hugo was executive director of the Verein Deutscher Eisenhüttenleute, Düsseldorf, a German technical society similar to American Foundrymen's Society in function. He had held this position since 1942 and took a very active part in reconstructing the German foundry industry after 1945. He was editor in chief of *Giesserei*, the technical publication of his organization.

Studied Mining in Aachen

Dr. Hugo studied mining engineering and foundry technology at the Institute of Technology, Aachen, and wrote his doctorate thesis on gray iron in 1935. He was later engaged in the establishment of a materials testing laboratory at Junkers Airplane and Motor Co. He was later made Director of Laboratories with that company.

He subsequently took a position on the Munitions Board of the war department, and was later appointed liaison officer at the Bavarian Motor Works in Munich. Dr. Hugo leaves many friends within the foundry industry in the United States as well as in his native country.

Test your foundry knowledge with "The Foundry Quizmaster." Your reward for taking the quiz: Increased knowledge of foundry practice. Questions this month deal entirely with yellow brass. They were prepared by Chester L. Mack, Chautauqua Hardware Corp., Jamestown, N. Y. Answers will be found on page 81.

1. The use of aluminum as a deoxidizer promotes fluidity and pleasing as-cast appearance but increases interdendritic shrinkage and porosity. True _____. False _____.

2. The use of a deoxidizing agent (aluminum or phos-copper) may not be necessary if melting atmosphere is reducing and care is used in pouring. True _____. False _____.

3. To cast a thin flat plate free of shrink cracks or defects it must be fed with a horn gate to the center or by riser, unless cast against a chill. True _____. False _____.

4. A very thin, hard-running casting will have less fins or strains if provided with a whistler or vent. True _____. False _____.

5. Up to 5 per cent lead content makes castings easier to polish. True _____. False _____.

6. Even the smallest pipe fitting (1/4 in.) must be cored to avoid leakers due to interdendritic shrinkage. True. _____. False _____.

7. When two heavy sections are joined by a short, thin section or valley, the casting must be fed at this point. There is no exception to this rule. True _____. False _____.

8. Yellow brass has a tendency to be porous and spongy in the center of heavy sections. If the casting must be tight grained throughout, it would be cheaper to change to a different alloy. True _____. False_____.

9. It is believed that the mold cavity should be filled rapidly to avoid defects from zinc oxide. This is not necessary if the mold is freely vented. True _____. False _____.

10. Excessive tumbling or shot blasting will harden the castings and will increase rather than decrease polishing costs. True _____. False _____.

11. Lead in amounts of more than 4 per cent will produce segregation and so-called dirty castings. True _____. False _____.

12. The use of fluxing agents causes heavy losses in metal. The high zinc content provides enough fluxing action. True _____. False _____.

13. Common, yellow brass ingot contains more undesirable elements than other alloy. True _____. False _____.

14. The ratio of copper to zinc content may vary up to 10 per cent without affecting the castability or color of the metal. True _____. False _____.

15. Yellow brass molds need more permeability than the tin bronzes or ounce metal. True _____. False _____.

16. Yellow brass is not cast profitably in permanent molds. True _____. False _____.

17. Regardless of the size or shape of the casting, the proper pouring range is 1950 to 2150 F. True _____. False_____.

18. Since temperature does not always determine fluidity, a kicking rod in the crucible is as effective as a pyrometer in testing a heat. True _____. False _____.

19. Any material producing a reducing mold atmosphere will give better finish and sharper detail. True _____. False _____.

Castings Shipments Up

The U. S. Department of Commerce has announced that shipments of ferrous castings during June, 1953, totalled 1447 thousand short tons, 396 thousand tons over June, 1952.

Members of the French National Defense Aircraft Engine Productivity Team, shown here, were recently guests of the Cooper Alloy Foundry Co., Hillside, N.J. Touring the U.S. under the guidance of M.S.A., the team is studying aircraft engine production methods. Herbert J. Cooper (front row, extreme left), executive vice-president at Cooper Alloy, was host to the group on a tour of the plant.

Meeting Programs Listed For Three Regional Conferences

New England Regional

The 13th New England Regional Foundry Conference will be held on October 23-24 at Massachusetts Institute of Technology, Cambridge, Mass. It will again be co-sponsored by New England Foundrymen's Association and American Foundrymen's Society.

Frank R. Elliott, Westinghouse Electric Corp., is General Chairman; Howard B. Nye, Crompton & Knowles Loom Works, heads the program committee; and Henry G. Stenberg, Draper Corp., is in charge of publicity.

Registration for the sessions will be from 9-9:30 am on October 23; and 8-9 am, October 24. The tentative program is listed below.

Friday, October 23, 1953

9 to 9:30 am: Registration

9:45 am: Opening of Conference
Chairman: Frank R. Elliot
Westinghouse Electric Corp.

10 am: Address of Welcome—Admiral C. L. Cochrane, Dean of Engineering, Massachusetts Institute of Technology

10:15 am: Two Sessions—Ferrous & Non-Ferrous
Ferrous *"A Summary of Recent Developments in the Foundry Industry"*
Howard H. Wilder—Vanadium Corp., Book Tower, Mich.
Chairman: Stanley H. Bullard—The Bullard Co.

10:15 am: Non-Ferrous Chairman: S. W. Chappell
Co-Chairman: Clyde Lake

12 Noon: Lunch—Walker Memorial

1:30 pm: "Maintenance of Foundry Equipment"
George Miller—Osborn Co.
Chairman: C. W. Hutchins—Standard Foundry Co.

3 pm: Labor Relations
"Foreman Training in the Foundry Industry"
John W. O'Toole—Crompton & Knowles Loom Works
Chairman: Raymond F. Meader—Whitin Machine Co.
Co-Chairman: Paul Mongeau—Joy Manufacturing Co., Claremont, N. H.

6 pm: Conference Dinner
Chairman: Professor H. F. Taylor
Co-Chairman: T. I. Curtin, Jr.
Speaker from Mystic Iron Works

Saturday, October 24, 1953

8 to 9 am: Registration

9 am: "Sand Control in Relation to Casting Finishes"
Martin Pepper—Whitehead Bros., New York City
Chairman: Wm. N. Ohlson, Draper Corp.

10:30 am: Two Sessions—Ferrous & Non-Ferrous
Ferrous *"Quality Control in the Small Foundry"*
William J. Sommer, Plainville Casting Company
Chairman: Forrest Scott, Narragansett Gray Iron Foundry
Non-Ferrous: To be announced

12 Noon: Lunch—Walker Memorial—Frank R. Elliot presiding

2 pm: "Getting the Most from your Cupola"
Daniel Krouse, Gray Iron Research Institute
Chairman: Joseph Stazinski
General Electric Co.

3 to 4:30 pm: Open House—Sloan Memorial
Exhibit of shell moulding machine by Shell Process Inc.

Northwest Regional Conference

The fourth annual Northwest regional Conference is scheduled for October 16 and 17 at Seattle. The first day's sessions will be held at the Hotel New Washington; those of the second day on the campus of the University of Washington.

Cooperating with the University, the following AFS Chapters are sponsoring the meeting: British Columbia, Oregon, Washington, and Oregon State Student.

Conference Chairman is Edward D. Boyle, Puget Sound Naval Shipyard. The program committee Chairman is James F. Dolansky, Griffin Wheel Co. Other committee chairmen are: Publicity: Fred R. Young, R. A. Wilcox Co.; Reception: James D. Tracy, Salmon Bay Foundry Co.; Finance: James F. Dolansky; Plant Visitation: Harold R. Wolfer, Puget Sound Naval Shipyard; Accommodations: J. V. Reardon, Federated Metals Co.; Records: Harold R. Wolfer; Registration: Carl P. Irwin, Ingersol Rand Co.; Entertainment: Thomas F. Meagher, Laclede-Christy Co.; Transportation: J. V. Reardon; Ladies' Entertainment: Mrs. T. F. Meagher.

Friday, October 16, 1953

Registration all day Friday—Mezzanine, New Washington Hotel

Friday Morning:
Field trip to Puget Sound Naval Ship Yard, Bremerton, Wash.
Leave Seattle by Ferry........9 am
Return to Seattle by Ferry..12 Noon

Friday Afternoon:
Technical Session—Flamingo Room, New Washington Hotel
Technical Session Chairman—Wm. Mackey, Washington Stove Works

"Gas in Metals" Dr. L. W. Eastwood, Asst. Director, Division of Metallurgical Research, Kaiser Aluminum & Chemical Corp.

Session Chairman—Wm. R. Pindell: N. W. Foundry & Furnace Co.

"Refractories" A. Lee Bennett, Vice-President, Research & Development, Gladding McBean & Co.

Session Chairman—Wm. Ralph Holeton, Jr., British Columbia Research Council, Vancouver, B. C.

Friday Evening:
Banquet—Windsor Ballroom—New Washington Hotel
Master of Ceremonies—Charles M. Anderson, Eagle Metals Co.
Speaker—Professor Warren E. Tomlinson, College of Puget Sound

Saturday:
Ladies Program
Luncheon—Town & Country Club

Saturday, October 17, 1953

Technical Sessions: To be held in Guggenheim Hall, University of Washington

Saturday Morning:

8:30 am: Bus leaves Second Avenue entrance of New Washington Hotel Registration Saturday morning at Guggenheim Hall and Mezzanine floor of New Washington Hotel

"Basic Cupola"—Harry H. Kessler, Manager Foundry Operations, Sorbo-Mat Process Engineers

Session Chairman—James F. Dolansky, Griffin Wheel Co.

"Sand Reclaimation"—Cliff Winniger, National Engineering Co.

Session Chairman—Prof. Edward H. Rowe, University of Washington

Luncheon at "The Hub" On The University of Washington Campus

Chairman and Master of Ceremonies—Prof. Gilbert S. Schaller, University of Washington

Saturday Afternoon:

"Shell Molding"—Bernard N. Ames, Supervision Physical Metallurgist Material Laboratory, New York Naval Shipyard

Session Chairman—James N. Wessel, Puget Sound Naval Shipyard

"Shell Molding Machines"—Frank K. Shallenberger, President, Shalco Engineering Corp.

Session Chairman—James N. Wessel Puget Sound Naval Shipyard

5:30 pm: Bus leaves for New Washington Hotel

Saturday Evening:

Post Conference Party

9:00 pm: Conference Dance, Windsor Ballroom, New Washington Hotel

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Purdue Metals Casting Conference

Purdue University, at West Lafayette, Ind., is again to host the Purdue Metals Casting Conference on October 29 and 30. Central Indiana and Michiana Chapters of AFS are sponsoring the meeting, in conjunction with the University and its AFS Student Chapter.

J. A. Barrett, National Malleable & Steel Castings Co., is General Chairman, assisted by C. T. Marek of the University as Co-Chairman. Program Chairman is Vern Spears, American Wheelabrator Corp., who will be assisted by J. P. Lentz, International Harvester Co.; L. Essex, Golden Foundry Co.; R. H. Greenlee, Auto Specialties Mfg. Co.; L. V. Kirkman, Harrison Steel Casting Co.; W. V. Johnson, Oliver Corp.; J. F. Kaufman, Studebaker Corp.; E. C. Richardson, Delco-Remy Div., G.M.C.; R. W. Lindley, H. A. Bolz, and M. M. McClure, of Purdue University.

Thursday, October 29, 1953

9 am: Registration

10 am: Welcome

Dean G. A. Hawkins, Dean of Engineering, Purdue University.

Response by Industry

Frank Dost, Vice-President, American Foundrymen's Society.

Speaker: Clyde R. Powell, Public Relations Director, Lehigh Shoe Co.

Subject—*"Human Relations."*

Chairman

H. A. Bolz, Head, Department of General Engineering, Purdue University

12:30 pm: Lunch

1:30 pm: Speaker: C. W. Hockman, Foundry Superintendent, Cadillac Motor Car Division, G. M. C.

Subject—*"Automatic Core and Mold Production."*

Chairman

J. P. Lentz, International Harvester Co.

3 pm: Speaker: J. F. Kaufman, Foundry Engineer, The Studebaker Corp.

Subject—*"Pneumatic Sand Transfer"*

Chairman

G. C. Dickey, Harrison Steel Castings Co.

6:30 pm: Banquet, North Ballroom

Speaker: Dr. Earl Butz, Purdue University

Subject—*"Production, Progress, and Prosperity"*

Toastmaster

R. W. Lindley, General Engineering Department, Purdue University

Friday, October 30, 1953

10 am: Speaker: K. E. Robinson, Ventilation Engineer, Industrial Hygiene Department, General Motors Corp.

Subject—*"A Million Dollars Worth of Dust Collection Equipment Won't Do a Bit of Good Unless Properly Hooded."*

Chairman, George Adler, Safety Director, Auto Specialties Mfg. Co.

11:15 am: Speaker: Charles Locke, Works Manager, West Michigan Steel Foundry Co.

Subject—*"Some Modern Concepts of Gating and Risering"*

Chairman, Martin Lefler, Oliver Corp.

12:30 pm: Lunch

1:30 pm: Speakers: Clyde A. Sanders, Vice-President, American Colloid Co. Professor C. C. Sigerfoos, Michigan State College

Subject—*"Effect of Mold Materials on Metal Shrinkage"*

Chairman, R. P. Schauss, Sales Manager, Werner G. Smith Company

What Is America?

What is America? What is the U.S.A.?
Well, it is purple mountains and
fruited plains—
But it's smoke stacks and railroad
ties too
It's air coaches and ice-cream sodas
Be-bop and symphonies
It's Christmas stockings and
plush hotels
Production lines and skyrockets
It's TV sets and antique shops
Advertising signs and factory whistles
You can put all that together—
and add a million bags of fertilizer—
a thousand juke boxes—
a hundred Diesel locomotives—
But the inventory isn't started.

For America's also the
country preacher's warm handclasp
The quick come-back of the smart-
looking stenographer
It's the set jaw of the high school
half-back
The sharp eyes of the farmer
It's the soft quiet talk of a mother
to her baby
The big laugh at the bowling alley
The close harmony at a weiner roast
It's the crackle of ham and eggs frying
The smell of gasoline exhausts
and popcorn—
But America isn't just the sum
and substance of all things
you see and hear and touch.

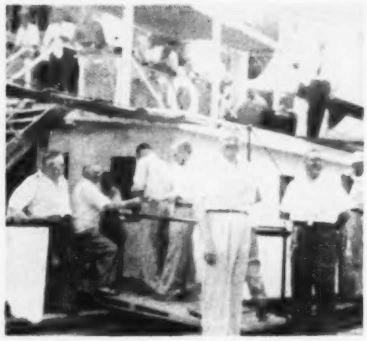
America is ideals—beliefs—feelings—
The opportunity to work your way
through college selling magazines
To invent and sell a million
new can-openers
To get a job or quit one
To open a hot dog stand
or farm your land.
It's the freedom to talk back
to a cop or boo a politician
To invest your money or hide it
under the mattress
To worship God in your own way
To run your own life.
But, you have to look ahead
to see America
for, most of all,
America is a state of mind
—a point of view—
A love of moving on—
Beyond the next hill—
The next filling station—
The next frontier—
Expanding—growing—living—
—Beyond the horizon.

THAT'S AMERICA!

THAT'S THE U.S.A.!

Chapter News

Attending the Detroit Chapter's board meeting in August, reading clockwise are: Steve Pasick, director; Charlotte Gorney, assistant secretary; Claude B. Schneible, vice-chairman; Vaughan C. Reid, past chairman, and Harry E. Gravlin, Jr., chairman.



Members of the Chesapeake Chapter and their guests are shown going aboard at the chapters second Annual Crab Feast and Boat Trip held in July.

★ Goal Is 12,000 Members

A membership target of 12,000 by June 30 of 1954 was set at the Chapter Officers Conference held in May in Chicago. AFS membership as of September 4, 1953, was 11,059. With the fall meetings just starting, it is felt with continuing effort of the part of all chapter committee men and membership workers, this goal of 12,000 members will be reached early in the year. Let's all do our part to bring in new members! Two new company members have been added to the rolls recently. They are:

COMPANY MEMBERS

Mid-West Abrasive Co., Owosso, Mich.; R. J. Foresman, Vice-Pres. (Saginaw Valley Chapter).

Atlas Pattern & Mfg. Co., Inc., Detroit; Arthur J. Hermann, Vice-Pres. and Treas. (Detroit Chapter).

Detroit Chapter

Detroit Chapter officers and directors met August 12 to review the technical program for the coming year and to set up committees and lay plans for special activities. Chapter Chairman Harry E. Gravlin, Jr., Ford Motor Co., presided.

Program announced by Vice-Chairman Claude B. Schneible, Claude B. Schneible Co., includes three panel discussions, a casting clinic, two equipment sessions, a plant visit, and three special events. The latter, under the supervision of Special Activities Chairman Jess Toth, Harry W. Dietert Co., include a management meeting, a Christmas party, and a summer outing.

Named to serve on the Special Activities Committee were Michael Warchol, Atlas Foundry Co., E. J. Passman, Frederic B. Stevens, Inc., Roy Korpi, Ford Motor Co., and Vaughan C. Reid, City Pattern Foundry & Machine Co.

To lend continuity to program planning in future years, Chairman Gravlin appointed Roy Grant Whitehead, Claude B. Schneible Co., and Steve Pasick, Sterling Wheelbarrow Co., to a rotating Program Committee to serve, respectively, one and two years. A third man to serve three years will be appointed by next year's chairman and thereafter the retiring member will be succeeded by a three-year appointee.

Additional appointments were: Membership Chairman—Vaughan C. Reid; Educational Chairman—Howard H. Wilder, Vanadium Corp. of America; in charge of chapter-area uni-

AFS, Twin-City Chapter, foundrymen and their guests shown at the Annual Golf Tournament and Dinner, held at the Midland Hills Country Club, St. Paul, Minn. Over 200 members and guests attended.

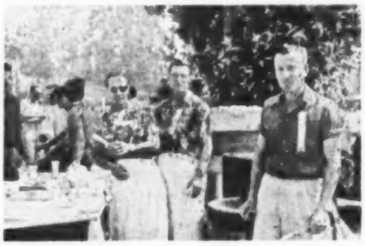
versity-student participation in the Michigan Regional Foundry Conference—Samuel H. Cleland, Eastern Clay Products Dept., International Minerals & Chemical Corp.; Pattern Contest—Paul B. Copeland, Ford Motor Co., and Messrs. Reid and Passman; and Publicity—Walter Kantzler, Kelsey-Hayes Wheel Co., and Grant Whitehead.

Southern California

Otto H. Rosentreter
National Engineering Co.

The sixteenth annual Summer Outing and Stag of Southern California Chapter was held August 15 at the Lakewood Country Club, Long Beach, Calif. Approximately 450 foundrymen and guests enjoyed the affair. The golf tournament, in which 100 golfers participated, was won by Harold Rice, who took low gross honors, while G. M. Jones was winner in the "blind bogey" division. Other sporting events included a horseshoe pitching contest and a soft ball game. Tony Tuzzolino, Overton Foundry, and Bill Baud, Mechanical Foundries, and their assistants, did a fine job manning the barbecue and free beer stand. Pete Valentine's trio provided the musical entertainment. A steak dinner and variety show completed the annual event. The success of the outing was made possible by the untiring efforts of J. A. Oliva, Oliva & Tatro Co., and his committee.

Taking time out at the annual Summer Outing and Stag of the Southern California Chapter, from left to right, are: Ken D. Hoke, McGown Co.; C. B. Callamon, Mechanical Foundries Div.; Earl K. Appleman, A. P. Green Fire Brick Co.; Otto H. Rosentreter, and Paul Crow, Phillips Foundry.



Manning the barbecue and beer stand at Southern California Chapter's annual outing are from left to right: Bill Baude, Mechanical Foundries Div.; Toyn Tuzzolino, Overton Foundry and Ed Worth, Mechanical Foundries Div.

J. S. Garski, left, Progress Pattern & Foundry Co., St. Paul, Minn., presents the grand door prize, a Champion outboard motor, to winner W. D. Murphy, right, Pioneer Engineering Co., Minneapolis, at the Twin-City Chapter outing.

Northwestern Pennsylvania

Roy A. Loder
Erie Malleable Iron Co.

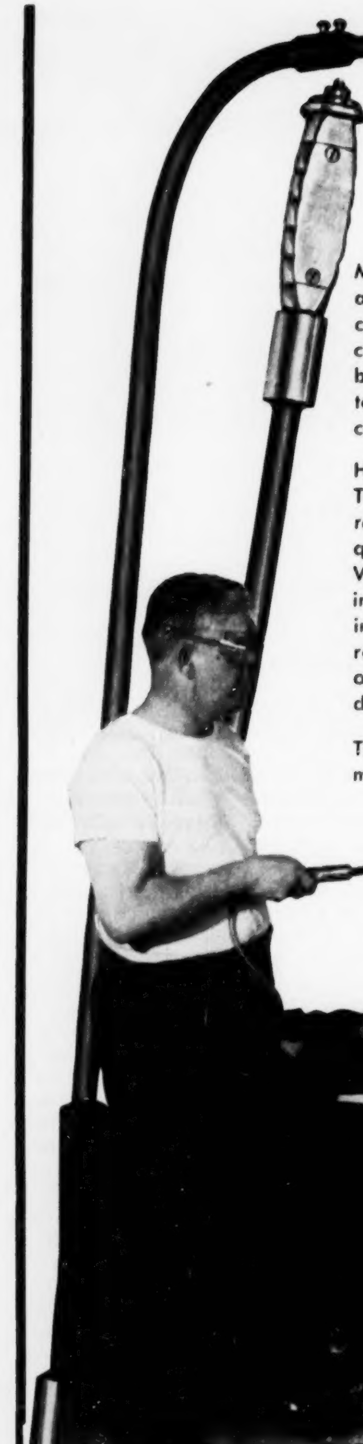
Northwestern Pennsylvania Chapter of AFS is cooperating with the Pennsylvania State College in a course in Gray Iron Metallurgy and Cupola Operation, to be held in the Academy High School. The course will extend for a period of 24 weeks with one session of three hours each. All classes will be conducted on a lecture-discussion basis.

The school will be under the tutorship of William Peelman, Bucyrus-Erie Co., Erie, Pa., and subjects to be covered will include: *Cupola Construction and Design, Refractories and Operation, Special Cupolas and Tuyere Arrangements, Metallic Charge Material and Calculation, Foundry Coke—Chemical and Physical Characteristics, Combustion in the Cupola, Pyrometry for the Cupola, Gas Analysis, Fluxing Materials; Slags, Desulphurizers, Effect of Desulphurizers, Inoculants, Ductile Iron, Sand Control, Gating and Risering and Analyzing Casting Defects.*

All registrants will be required to deposit $3.00 which will be returned on completion of the course. Other costs involved, will be the purchase of text books which will be the individual's personal property.

A film has been produced by the chapter, describing the possibilities for advantageous employment in engineering, metallurgical, molding, melting, finishing and service phases in the foundry industry by tracing the manufacture of a large jet engine casting through to its ultimate use in a jet plane. The script has been carefully prepared to avoid technical termi-

continued on page 105



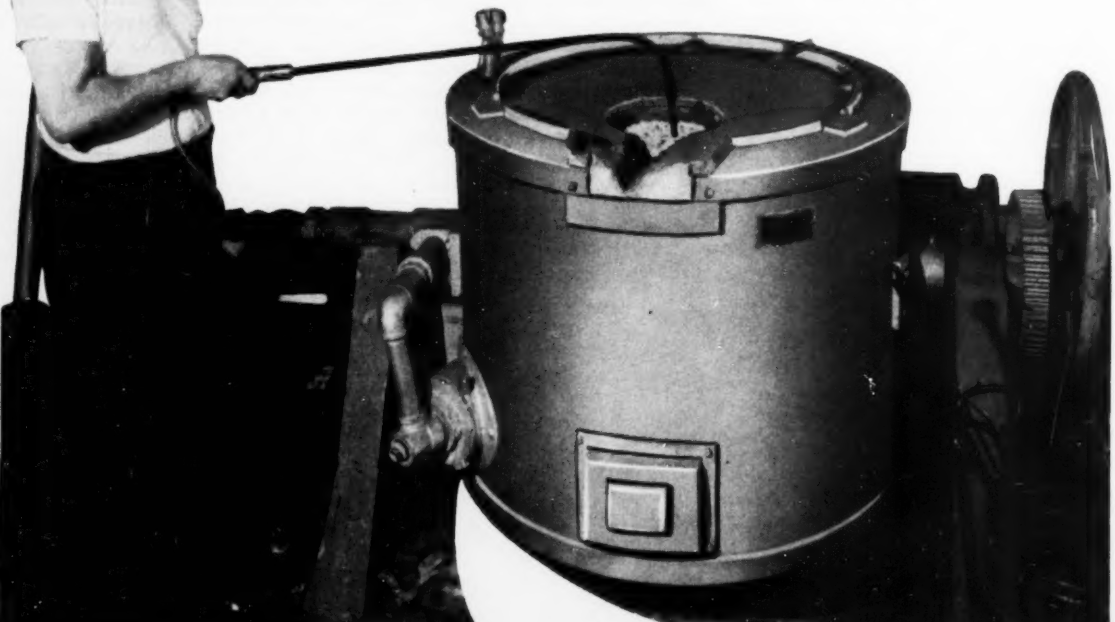
Close Control
OF POURING TEMPERATURES
-- A Means To Increased Output

More, and better, castings are produced at the foundry where molten metals are checked often for temperature. Frequent checking makes certain that metals will be poured at correct heat, the first step toward the production of sound, flawless castings.

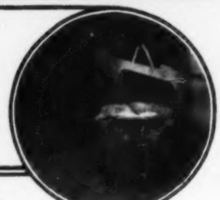
Here is where Marshall Enclosed-Tip Thermocouples "come in". Foundrymen rely on Marshall Thermocouples for a quick, accurate temperature reading. When the protected tip of a Marshall instrument is dipped into the melt, the indicator pointer quickly swings to a reliable report. There is no long interval of delay. The response is quick and definite.

This hot-junction tip is protectively armored. It endures the corrosive action of the hot metals and slag. When the tip of Marshall Thermocouples finally wears out or burns out it can be instantly renewed. A new replacement unit is slipped into place by merely adjusting two screws and attaching thermocouple wires to the binding posts. No special skill is required.

Marshall Enclosed-Tip Thermocouples are a foundry tool that will increase your own output of brass, bronze, aluminum or magnesium castings. They also reduce your losses from imperfect castings and "rejects". Gassed castings, excessive shrinkage, coarse grain-size, misruns, are all a loss that can be largely eliminated. Install the use of Marshall Thermocouples in *your* melting room. They will aid you to assure a dense, sound, uniform casting output.



MARSHALL thermocouples



L. H. MARSHALL CO., 270 W. Lane Ave., COLUMBUS 2, OHIO

Quizmaster

These answers to the questions on page 75 were provided by the Technical Dept. of H. Kramer & Co., Chicago.

1. True. Due to the aluminum oxide skin formed on the liquid metal, with an addition of approximately 0.15-0.25 per cent, the fluidity is improved and a cleaner cast surface is obtained. Interdendritic shrinkage is accentuated with the aluminum addition, especially on the leaded alloys.

2. True. The flushing action of zinc vapors through the liquid metal will prevent any gas problems. The use of a reducing atmosphere will prevent the formation of oxides while melting; however, since the metal is poured through air and into a mold cavity containing air, there should be no turbulence in the gating system to help prevent the formation of dross. For consistent results, a deoxidizer (fluidizer) should be used.

3. True. To avoid center-line shrinkage, some method of obtaining directional solidification is required. However, a horn gate is an uneconomical method of molding this type of casting.

4. True. Whistlers or vents relieve the pressure due to mold gases and zinc oxide, thus allowing the metal to fill the mold without restraint.

5. True. If hardness is the only criterion of easy polishing, this would be true. However, there is a tendency for lead streaks with too high a lead content.

6. True. Heavy sections are prone to internal porosity, and leaky castings may be developed. Therefore, if at all possible heavy sections should be cored out. However, many pressure castings are being cast solid and then machined.

7. False. The heavy sections must be chilled or properly risered, that is, with the gate into the riser, so that hot metal would be available. Gating into the thin section of the casting would cause shrinkage in the heavy sections.

8. True. If unsuccessful, after trying several procedures to determine the feasibility of making a pressure-tight casting with yellow brass, then it might prove to be more economical in the long run to make the casting from another alloy that lends itself to pressure castings.

9. True. Not only should the mold be well vented, but the sand should be on the dry side, and the metal should have little, if any, phosphorous addition.

10. True. It is true that excessive tumbling or shot blasting will harden the surface, but not enough to affect polishing costs one way or the other. What constitutes an easy or hard casting to polish has always been a controversial subject and varies from one plant to another.

11. True. However, good foundry practice may correct the effects of high lead.

12. True. The use of powdered fluxes to clean the metal of oxides also entraps pellets of the base metal, thus causing heavy losses in metal. The flushing of zinc vapor through the liquid metal should remove the gases and also allow the oxides to rise to the surface, where they may then be removed by skimming.

13. False. To make the alloys to definite standards, i.e., ASTM specifications, etc., considerable refining is required, whether it is yellow brass, red brass, leaded tin-bronze, or high lead-tin bronze.

14. False. For example, a 70 Cu-30 Zn alloy is yellow and a 60 Cu-40 Zn alloy is pink. A large variation in the Cu-Zn ratio will also change the shrinkage characteristics of the alloy.

15. True. For the same size castings, yellow brass should be cast in a more open sand because of the condensation of zinc oxide.

16. False. With the addition of 0.15-0.25 per cent aluminum to the alloy, satisfactory castings may be made in permanent molds. Also, considerable amounts of yellow brass are being die-cast.

17. Rather than state a definite pouring range for an alloy, it is the best practice to pour a casting at the lowest possible temperature, but still hot enough to avoid misruns and internal shrinkage.

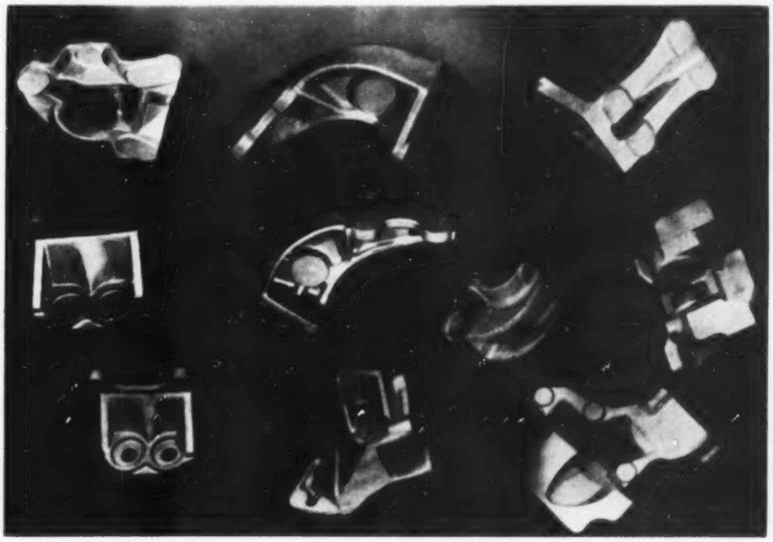
18. False. For any one alloy, pouring temperature is an indication of fluidity.

19. True. Good detail and finish may be obtained, but the quality of the metal may be impaired by the reducing mold atmosphere.

Offer Radiography Course

The first in a series of two-week training programs in the use of cobalt-60 in industrial radiography will be offered early this fall by Technical Operations, Inc. The program will include health physics, the handling of cobalt-60 and other gamma sources, and practical and theoretical aspects of industrial radiography in general.

Enrollment will be limited. For full details, consult Technical Operations, Inc., 6 Schouler Court, Arlington 74, Mass.



Aluminum sand castings made by Oberdorfer Foundries, Syracuse, N.Y., have helped eliminate 1000 lb in weight of tractors without sacrificing strength. Cast parts include brackets for steering gear, engine, springs, air chamber, breaker spider.

News of Technical Committees

Light Metals Division

Chairman M. E. Brooks, Dow Chemical Co., presided over the Executive Committee meeting of the Light Metals Division, held in Chicago on August 12. Principal item of business was a discussion of the program for the 1954 Convention. Program Chairman E. V. Blackmun, Aluminum Co. of America, presided over this phase of the meeting.

As of August 1, papers were tentatively scheduled on permanent molding, titanium, gating principles, and fluid flow. Other papers on titanium, gating, and die casting were tentatively offered. Additional requests have been made for others on magnesium, without definite commitment.

Titanium Committee Formed

Chairman Brooks asked the advice of the group about bringing a titanium casting representative into the Executive Committee. A motion was proposed and carried that a Titanium Casting Committee be formed within the Light Metals Division. Chairman Brooks will appoint a chairman, who will automatically become a member of the Division's Executive Committee.

Subjects for the round table luncheon at the Convention were discussed. From among several, the new research committee motion picture on fluid flow in vertical gating was selected as the best topic, and it will be scheduled for the luncheon.

Sand Division

The AFS Sand Division's Executive and Program and Papers Committee met on August 17 in Chicago, with the 1954 Convention the principal topic.

The meeting was presided over by Chairman F. S. Brewster, H. W. Dietert Co. Mechanics of preparing and submitting papers were discussed by H. J. Heine of AFS.

The Sand Division will schedule six sessions, preferably with two papers per session. Three shop course meetings will also be scheduled.

Some of the committee members thought that papers should be of a practical nature, others that they should be theoretical but presented in understandable terms. It was felt that the Convention papers should be preprinted where possible in order to create interest.

Suggested titles for Convention papers included: high pressure molding, "D" process, sand flowability, stickiness, evaluation of sand tests, bakability, malleable or gray iron sand practice, blowability of sand, sand mixing, shell molding, casting surface finish, casting defects related to Ph, sea coal, and scabbing.

New Committee Suggested

A suggestion was made by C. A. Robeck of the Brass and Bronze Division, that a committee on non-ferrous sands be formed in the Sand Division. The new committee would study synthetic sands, with special emphasis on casting quality and surface finish. A motion to that effect was made and carried. The title will be "8U, Brass and Bronze Sand Properties Committee."

Steel Division

Chairman G. W. Johnson, Vanadium Corp. of America, presided over the Executive and Program and Papers Committees, which met in Chicago on August 21.

The Chairman stressed that Steel Division papers at past Conventions had been too theoretical, and that a serious problem exists in creating more interest.

Three technical sessions, with two papers per session, and a round table luncheon will be scheduled at Cleveland. Various subjects for proposed papers were reviewed. The suggested authors will be contacted by committee members.

The $12,000 research fund, recently made available at Armour Research Foundation by American Steel Foundries, was discussed. Various suggested projects were reviewed and AFS Assistant Technical Director H. J. Heine was authorized to explore the matter.

Gray Iron Division

The Executive and Program and Papers Committee of the Gray Iron Division met on August 18 in Chicago, with Chairman J. S. Vanick, International Nickel Co., presiding.

The Division will plan five technical sessions, with 10-15 papers, and one round table luncheon at the 1954 Convention. Three shop courses are also on the schedule.

Topics for papers and subjects for shop course sessions were taken into consideration. Further contact work is necessary in order to complete the Gray Iron program.

It was suggested that, during the round table luncheon, a "European Report" on foundry practice across the Atlantic be made. Chairman Vanick agreed to contact American foundrymen who will be visiting in Europe in order to form a qualified panel.

The Light Metals Division Executive Committee met in Chicago on August 12. Shown are, standing, from left: A. W. Stolzenburg, Aluminum Co. of America; E. V. Blackmun, Aluminum Co. of America, and Committee Vice-Chairman; D. L. LaVelle, American Smelting & Refining Co.; W. A. Mader, Oberdorfer Foundries; C. E. Nelson, Dow Chemical Co.; F. P. Strieter, Dow Chemical Co., Committee Secretary; and H. L. Colwell, Apex Smelting Co.; H. J. Heine, AFS; H. Brown, Solar Aircraft Co.; A. J. Marotta, Utica Radiator Corp.; Committee Chairman M. E. Brooks, Dow Chemical Co.; and W. E. Sicha, Aluminum Co. of America. Meeting was held at the Hotel Sherman.

SANDSLINGER

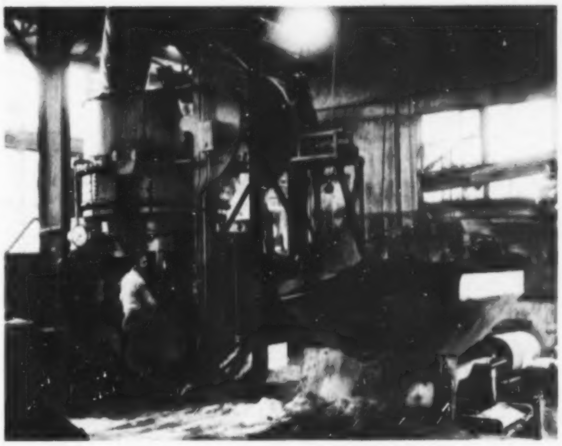
Flask and pit molds are rammed on both sides of the slinger's track.

Cuts Molding Time in Half at ST. MARYS FOUNDRY!

A single Speedmullor-Preparator Unit prepares all molding and core sand

Top quality machine tool castings, weighing up to 12,000 lbs., are produced at the St. Marys Foundry Co., St. Marys, Ohio. To do the job right, this foundry uses a Motive Sandslinger to ram all of the medium and large molds, and a Speedmullor-Preparator Unit to thoroughly condition and mull all molding and core sand.

St. Marys management reports that the slinger cuts molding time in half on their average mold. The Speedmullor-Preparator Unit replaced a smaller Speedmullor that was in operation over eleven years with *no* down-time.



All of the foundry's molding sand is conditioned and mulled during the day. Core sand is prepared in two hours each night.

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Foundry Tradenews

Advances in metals and related products are expected to be hastened by a new metallurgical development laboratory in Schenectady, N. Y., planned by the **General Electric Co.** The new facility, a part of the company's multimillion dollar research laboratory at the Knolls near Schenectady, will provide more than 70,000 sq ft of floor space, raising the gross area of the laboratory to more than half a million sq ft. It will be the eighth building of those comprising the research laboratory. Construction is expected to start shortly, and the building is scheduled for completion by the spring of 1955.

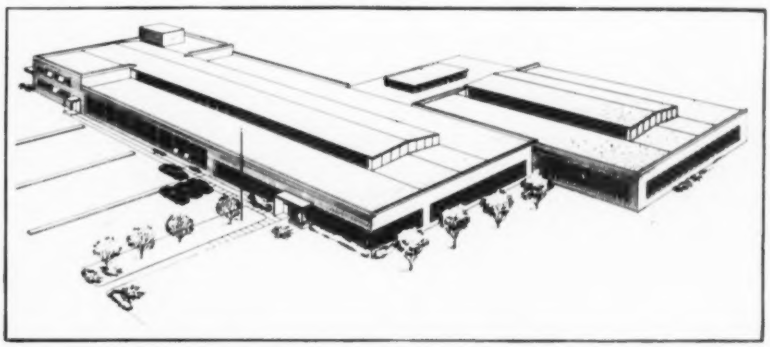
American Sterilizer Company has announced the immediate construction of the first unit of a projected 56 acre plant development program. The first unit covering 95,000 sq ft will consist of a foundry, warehouse, metal fabrication department, research and development laboratory and a power plant for heating and testing services and is located just outside the western city limits of Erie, Pa. The 56 acres are bounded on the north by the Nickle Plate Railroad and on the south by Route 20. Principal products of the new unit will be brass, bronze, nickel bronze, manganese bronze and aluminum, all captive, and capacity is expected to be 1,250,000 lb per year. The first unit, to cost $1,000,000, is scheduled for occupancy by May 1954.

U. S. Fire Protection Engineering Service, Inc., Kansas City Mo. has been organized recently. Comprised of consulting engineers and specialists located throughout the country, its purpose is to serve the need for specialized fire protection, by assisting clients in achieving and maintaining a fire-safe and economically-insurable operation. The new company has no connection with any insurance company, equipment manufacturer, or construction contractor.

A new service of **Frederic B. Stevens, Inc.,** has been inaugurated with the opening of a customer service warehouse in Springfield, Ohio. Customers in the Ohio area were notified of the contemplated move and, through the use of return post cards, were given the opportunity to specify items they would like stocked. The warehouse is being operated in conjunction with the Stevens plant in Springfield.

Floor area of the Yellow Springs, Ohio, plant of **Morris Bean & Company's** Antioch Process aluminum foundry will be brought to 88,000 sq ft by a new addition now under construction. The new area will be in full production by January, 1954. Simultaneously with the plant addition, several steps are being undertaken to increase the capacity of the company's ductile iron foundry in Cedarville, Ohio. New electric furnaces for melting iron are being installed and by the first of the year it is anticipated that the production of the iron foundry will be four times the current level.

Sheboygan Castings Corp. has purchased the **Cherry Burrell Corp., Foundry Div.,** at 1723 Union Ave., Sheboygan, Wis. The company will continue the production of gray iron jobbing work. Harry P. Rogers, foundry manager for Cherry Burrell Corp., has joined the Sheboygan Castings staff as general manager.



New addition of the Yellow Springs, Ohio, plant of Morris Bean & Company's Antioch Process aluminum foundry. New structure is shown in upper right hand corner of drawing above.

The district office of **American Wheelabrator & Equipment Corp.** has been moved to 2406 W. Lunt Ave., Chicago. Robert M. Rich continues as district manager assisted by Lawrence W. Kohlmeyer and Floyd H. Toman as district sales engineers.

Chain Belt Co., Milwaukee, has purchased the **Shafer Bearing Corp.,** Downers Grove, Ill. for the purpose of broadening the markets for its power transmission products. The new addition will operate as the Shafer Bearing Div. of Chain Belt Co.

Tracerlab, Inc., has reduced its price on its Cobalt-60 radiography sources. Increased volume which has resulted in improvements and modifications in processing methods and equipment make the price cuts possible, it is said. Cobalt-60 sources are used by industry to test welds, castings, tank hulls, pressure vessels and other critical objects for flaws.

Arcair Co. has opened an eastern sales and distribution office at 423 S. Mt. Pleasant Ave., Lancaster, Ohio. The establishment of the eastern division is the first major expansion of the firm from its original western division offices and factory in Bremerton, Wash. The eastern unit will maintain a warehouse and permanent office and sales staff.

The general office of the **United States Pipe & Foundry Co.** Burlington, N. J., has been moved to 3300 First Ave., N., Birmingham, Ala. Sloss-Sheffield Steel & Iron Div. of the company will be consolidated with the general office departments in Birmingham and will no longer operate as a separate division. The Philadelphia sales office will be removed to the former general office building at Burlington and will be consolidated there with the eastern sales office.

Field tests of new and improved refractory materials are now being made by **Electro Refractories & Abrasives Corp.** in the kilns of several customers. Eight companies are participating in the tests at present. The new policy enables customers to make tests under actual working conditions without interfering with production. Some of the field tests will take one to two years to complete.

BUCKEYE CONTINUES TO DEVELOP AND IMPROVE CORE OILS AND FOUNDRY SUPPLIES

Photo taken in Core Room Dept., The Wm. Powell Co., showing baking oven and finished cores. In manufacturing its world famous valves, Powell uses Linseal Core Oils exclusively.

New, Improved
BUCKEYE & LINSEAL CORE OIL

Formulations continue to meet and solve today's core problems, in step with the ever changing foundry needs.

New, Improved
ECONOCORE LIQUID CORE COMPOUND

Offers a substantial saving when used as a partial substitute for core oil.

Perfected by the same company which recently scored an outstanding success with *SLINGER-SLICK* . . . improved Parlex Base Liquid Parting . . . Avon (white) Non Silica Parting and many other foundry supplies. New *LINSEAL "2400 Series"* Faster Drying Core Oils can save you money 3 ways . . . 1. No additives needed to hasten drying time because our "2400 Series" Core Oils are compounded especially to dry faster . . . 2. Where crowded core conditions are present, "Series 2400" will get your cores through the ovens faster and increase your production without increasing production space . . . 3. Because these core oils withstand over-baked conditions both large and small cores can be baked in the same oven during the same baking cycle . . . *Challenge us, on your company letterhead, to prove these facts—through a discussion with one of our technical sales engineers for a FREE Test Run. Write today to address below.*

Manufacturers also of Parlex and Avon Partings . . . Linseal and Buckeye Core Oils . . . Buckeye High Temperature Furnace Cement . . . Stick Fast Core Paste . . . Linco Core Compound . . . Buckeye Patented Flask Guides and Specialty Foundry Products.

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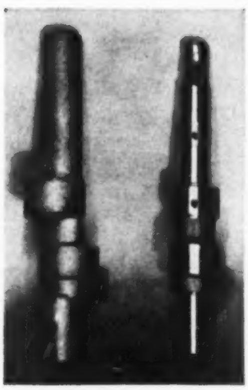
THE BUCKEYE PRODUCTS CO.

7020 VINE ST. • Cable Address "Buckprod" • CINCINNATI 16, OHIO

This furnace helps make ice cubes and cool breezes



TWO Detroit Rocking Electric Furnaces produce the iron alloys for castings used by York Corporation in their ice-making and air conditioning equipment. The furnace illustrated has an 8000 lb. capacity; the other's capacity is 2000 lbs.

In the York foundry, Detroit Rocking Electric Furnaces were chosen to meet the requirements for high quality heats produced with speed and economy. Rocking action of the furnaces makes full use of heat from the indirect arc, and guarantees a homogeneous melt. Better metal means better castings, fewer rejects, lower cost.

Investigate Detroit Rocking Electric Furnaces for your needs. For ferrous and nonferrous metals. Capacities from 10 to 8000 lbs. Each installation is engineered to fit *your* particular requirement, solve *your* problem.

Raw casting and finished crankshaft of York hermetic compressor. Cast from metal melted in Detroit furnace.

DETROIT ELECTRIC FURNACE DIVISION

KUHLMAN ELECTRIC COMPANY, BAY CITY, MICHIGAN

Foreign Representatives: in BRAZIL—Equipamentos Industrias, "Elsa" Ltd., Sau Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Cia Proveedora de Industrias, Atenas 32-13, Apartado 27A3, Mexico 6, D. F., Mexico; EUROPE, ENGLAND: Birlec, Ltd., Birmingham.

CONTROL

is our role!

On the seas, in a foundry or a steel plant . . . *control* is essential. It's the chief role of Keokuk Electro-Silvery Pig Iron in charging the cupola or blocking the open hearth. For with Keokuk, you are *assured* of *accurate* percentages of silicon . . . and, as suits your melt, alloys of manganese, chrome or nickel in various combinations. So, control both quality and costs with Keokuk. Write today for complete information!

KEOKUK

ELECTRO-METALS COMPANY

Keokuk, Iowa

Wenatchee Division: Wenatchee, Washington

In sailing, much depends upon control. Here, Chief Keokuk handles the tiller; Junior, the boom; and Princess Wenatchee makes ballasting an eye-popping pleasure!

Keokuk Electro-Silvery . . . available in 60 and 30 pound pigs and 12½ pound piglets . . . in regular or alloy analysis. Keokuk also manufactures high silicon metal.

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Stack Molding with Sterlings!

Pouring Metal into Stack Molds
In this modern foundry, molds are made in Sterling Steel Flasks stacked one above another, to a height of 10 or 12 sections. A common sprue, through each stack, feeds molten metal to runners leading to individual casting cavities.

★ ***Improves* Foundry Production**

★ ***Steps Up* Casting Output**

★ ***Saves* Valuable Floor Space**

Progressive foundrymen select Sterlings for modern stack molding operations. Why? Because they can step up casting production even in comparatively small quarters. Sterling Flask sections are "tailor-made" for stack molding operations. They are carefully fabricated from special hot rolled channel steel having a tensile strength of 70,000 lbs. The steel also has controlled carbon content and copper bearing... features that enable the flasks to withstand tremendous pressures. And they retain their rigidity and accuracy under constant production pressure. All types and sizes to meet your individual needs. Write for catalog.

STERLING WHEELBARROW CO., Milwaukee 14, Wis., U.S.A.

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ANOTHER MULTI-WASH SYSTEM — modelled for the modern mechanized foundry

Here in this foundry, modern mechanization and Schneible dust control are combined to provide, as nearly as possible, an ideal production atmosphere.

Sixty-five units of Schneible dust and fume control equipment help provide conditions that promote good health and greater productive effort.

Schneible patented features, a result of many years of dust control experience, give the utmost in efficient performance and low-cost maintenance.

Clients by the scores have enjoyed trouble-free operation of Schneible dust control equipment over the years.

Whether the job is large or small, Schneible engineers figure all the angles and come up with dollar-saving answers on overall operation. Controlled air velocities (summer and winter) . . . continuous re-use of water . . . localized collection . . . centralized disposal . . . no dust handling after collection.

Call in Schneible for a money-saving solution to your dust, fume or odor control problem. Call on experienced engineers in modern foundry ventilation.

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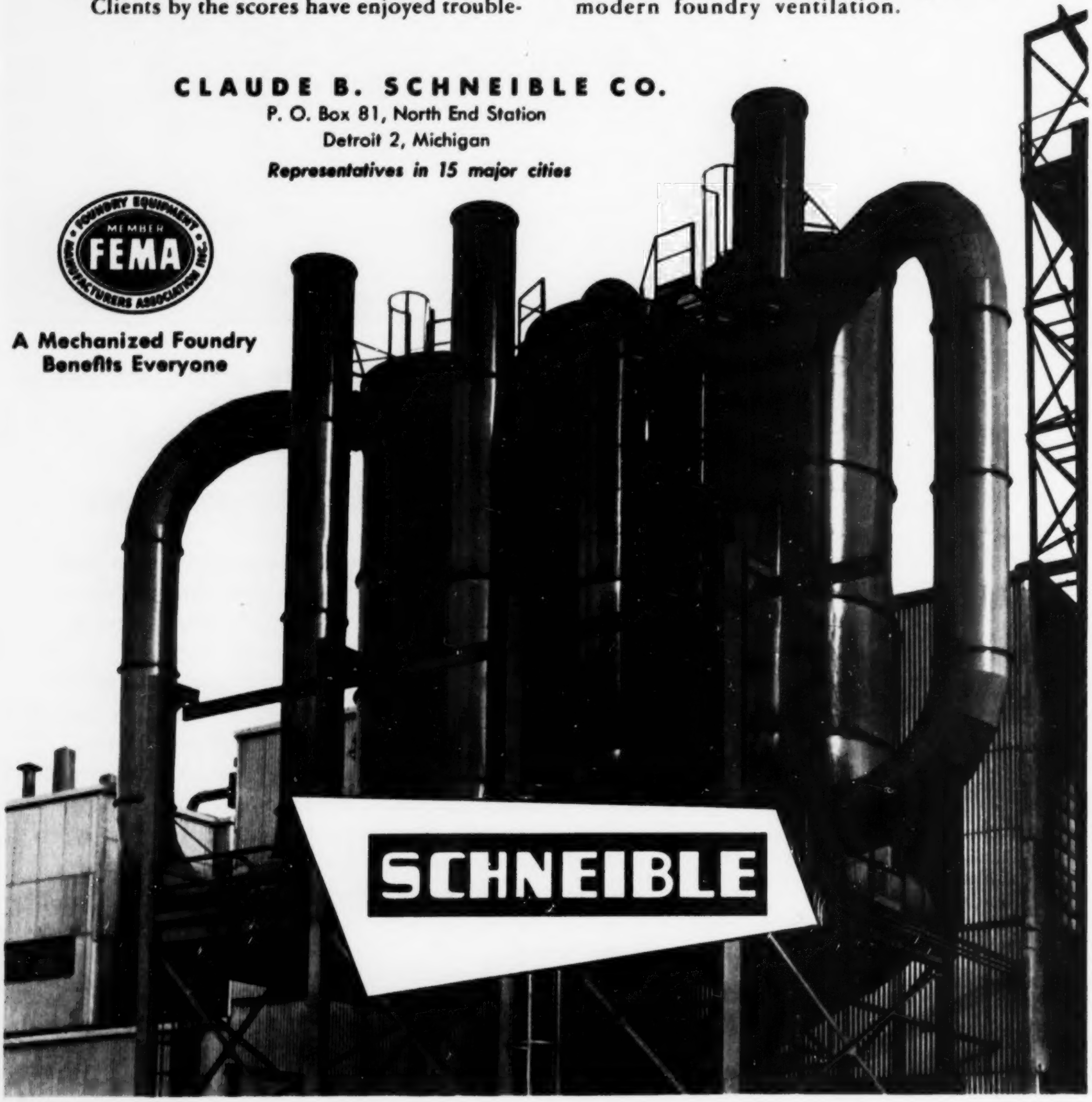
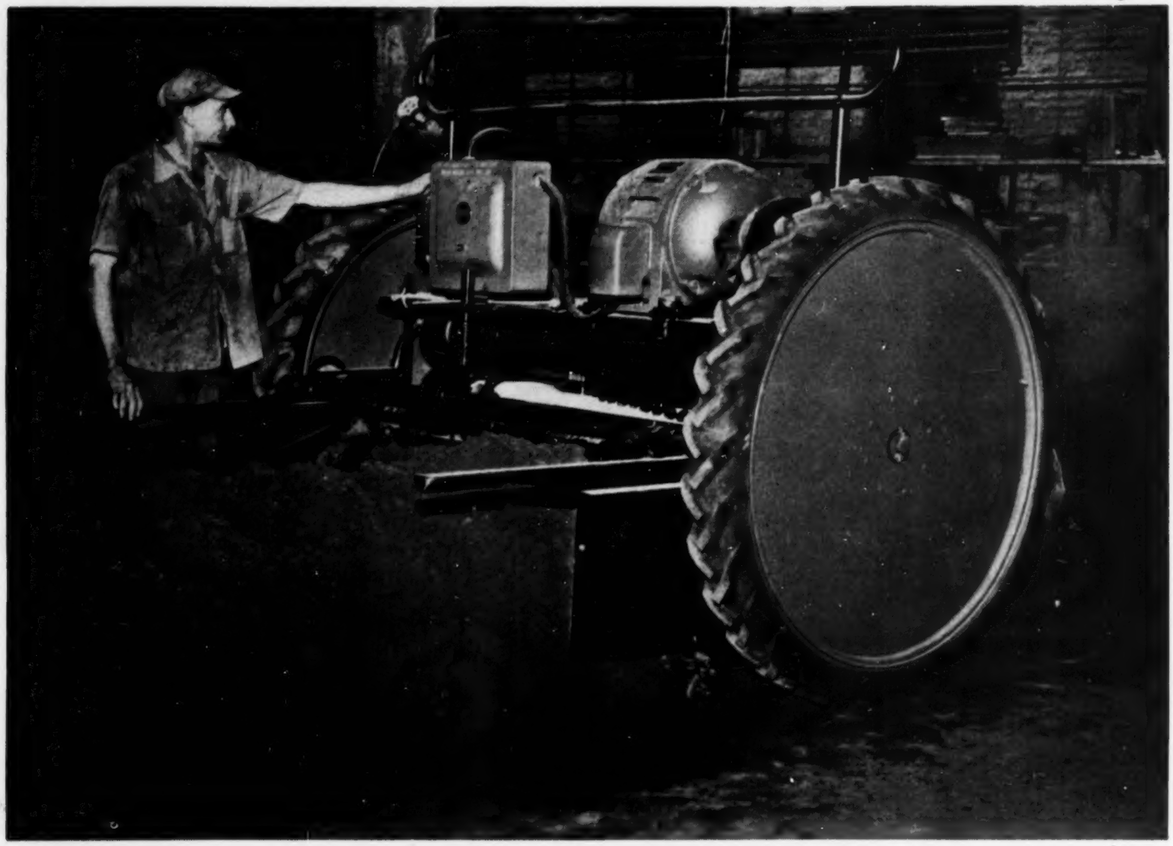
A Mechanized Foundry Benefits Everyone



The New Moulders' Friend
FINDS FRIENDS EVERYWHERE



MOULDERS like The New Moulders' Friend sand conditioner, because the blending action of the rotary wire brush thoroughly mixes and aerates the sand, making it easier to put up more and better molds.

NIGHT CREWS like it, because it eliminates much manual labor and does a better job of conditioning the sand. With this completely self-propelled machine one man can condition more than two tons of sand per minute.

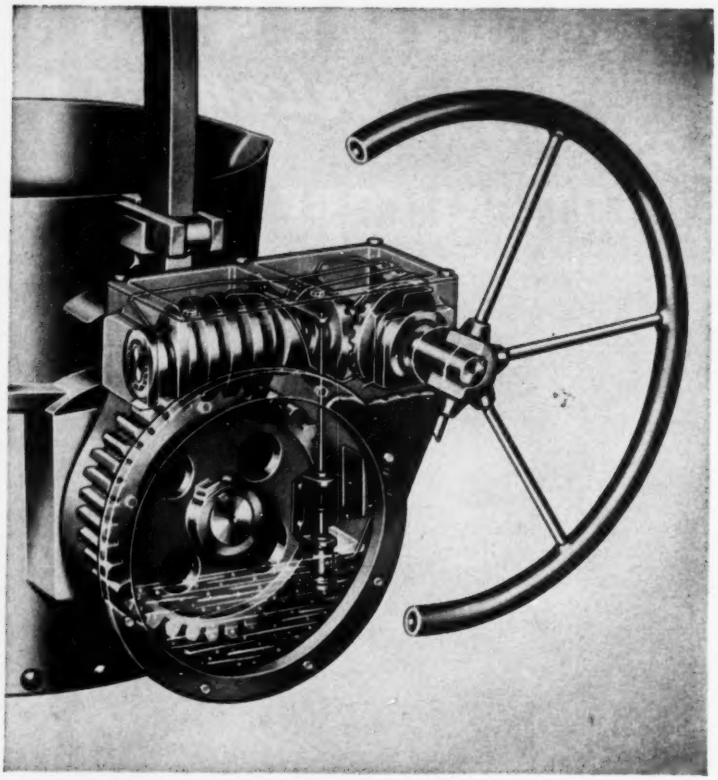
SAND CONTROL MEN like it, because it does such a thorough job of mixing, moistening and screening that they really can control the sand.

MAINTENANCE MEN like it, because it has few moving parts to keep in order.

YOU will like The New Moulders' Friend, because it pays for itself quickly with better castings and labor saved.

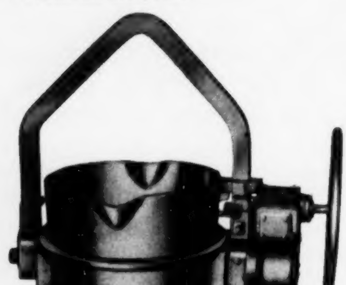
Investigate The Moulders' Friend today. See one in operation.

"The Moulders' Friend" — — **Dallas City, Illinois**



This Worm Ladle Gearing ELIMINATES GASKET ADJUSTMENTS

- Completely enclosed and self contained
- Automatic force-feed lubrication
- Positively self locking in any position
- Precision cut gears



Model 592T ladle with new type gearing. Also notice use of Industrial Equipment's much talked-about UNIVERSAL BAIL. This bail completely eliminates binding due to heat distortion or misalignment.

. . . WORM AND BEVEL GEAR ASSEMBLY COMPLETELY ADJUSTABLE

Here is another Industrial Equipment Company first . . . new, improved worm ladle gearing bringing *complete universal adjustability.*

Take a close look at the phantom view. Here is a one-piece, self-contained unit with all parts easily accessible. Your maintenance man can quickly make back-lash adjustments to pin-point accuracy and positive adjustment by adjusting the bearing lock nuts on all gears and worm. These nuts are easily reached and with working space to spare.

Unaffected by Heat

There is no connection between the bail and the gearing. No clearance for heat distortion is necessary, permitting an assembly almost to machine tool precision.

Industrial's new gearing is absolutely safe and positively self locking. The high ratio between worm and worm gear locks the ladle in any position. Incidentally, worm and bevel gears are of high tensile semi-steel and the worm is of high alloy steel. All are precision cut. Shafts are mounted on anti-friction bearings.

Now Standard Equipment

All Industrial geared ladles are now supplied with this outstanding new type of gearing. In addition, this gearing can be supplied for any Industrial worm geared ladles now in operation. *Write for details.*

Do you have our revised catalog No. 35?

Industrial

EQUIPMENT COMPANY

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FOUNDRY EQUIPMENT

LADLES • BOWLS • SHANKS • BAILS • TONGS • SPECIAL EQUIPMENT

Navy Revises Foundry Manual

The Bureau of Ships, Navy Department, recently announced that a contract had been awarded for the revision of the Bureau's *Foundry Manual.* The revision will include developments and improvements in foundry technology since the present manual was prepared. The manual is designed to provide both training instruction and reference material to naval personnel engaged in foundry work on board repair ships and tenders, and at shipyards and advance bases. It will be published in early 1954, according to present expectations.

Alloy Institute Appointees

Guy H. Baker, president of Alloy Casting Institute, has appointed Edward H. Platz, Jr., manager of alloy sales, Lebanon Steel Foundry, Lebanon, Pa., as chairman of the Institute's Public Relations Committee.

Named to serve with him on the committee were Brad B. Evans, Empire Steel Castings, Inc., Reading, Pa.; and C. M. Ruprecht, Electro-Alloys Div., American Brake Shoe Co., Elyria, Ohio.

The committee serves to promote continued research in the production of both corrosion and heat-resistant stainless steel alloys, and it works closely with research and development at Ohio State University, Massachusetts Institute of Technology, and Battelle Memorial Institute.

Safety Conference

A Conference on Safety and Hygiene is to be held at the University of Minnesota, November 23 and 24, presented by the Center for Continuation Study, University of Minnesota, and jointly sponsored by the Twin City Chapter and the National Headquarters of the American Foundrymen's Society.

A committee of the following men recently held a meeting to organize and set up a program for this Conference: Fred E. Berger, B. J. Derr, Carter De Laittre, Fulton Holtby, G. B. Milligan, O. Jay Myers, W. A. Porter, and C. F. Quest.

The Twin City Chapter circularized a questionnaire to all members, asking them what suggestions and problems they had relating to foundry safety and hygiene that would be of particular interest to them and from which they could get most help at a Conference of this nature. From the number of replies received, a very good attendance may be expected at this Conference. Foundrymen from other than the Twin City area are invited to attend this Conference.

Foundry Fire

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cost of production for every foundry.

We have some figures which may be interesting. In 1950 there were 389 foundry fires which were studied and investigated. Of these, 191 of the plants were protected with sprinkler systems or a fire brigade organized at the foundry, and the fire was extinguished or brought under control before the local fire department arrived at the plant. One hundred thirty-five foundries so protected had the fire controlled before damage of $250 resulted. Sixteen of these fires resulted in considerable loss, and it was found that, while some of them had sprinkler systems, the system was faulty; valves had corroded shut; water supply tanks were dry or the pipelines to them were corroded shut. This was definitely faulty maintenance, and these fires could have been prevented had a little fire prevention or preventive maintenance work been initiated.

It can well be worth a little time and effort on the part of every foundry to review its fire prevention program during the week of October 4-10. If you do not have a fire brigade of your own, it is a very inexpensive and yet very interesting program to start. We can quote one very successful plant fire brigade organized at the Hamilton Foundry and Machine Co., Hamilton, Ohio.

One other form of preventive maintenance is to call in your local fire department at least once a year and have them make an inspection of your plant. Then, if ever you do have a fire in the future, they will be acquainted with the plant, will know the plant set-up, and of course will be more efficient in handling the fire.

Engineering Publication

The Engineer's Council for Professional Development has published a booklet, *"Engineering—A Creative Profession,"* designed as an aid for young students in determining their careers.

The pamphlet is illustrated and outlines the function of the engineer in our society and the qualifications necessary to enter technological fields on a professional level. Other data outline the admittance requirements of engineering schools and colleges.

The booklet is a valuable one for persons concerned with career guidance. It is available for 25c per copy, and 20c per copy in lots of 50 or more. Write to the council at 29 West 39th St., New York 18.

By-Laws Revisions

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tion circles. For AFS it was hit upon as a practical recognition of Chapter importance in carrying out educational activities locally, organizing better Chapter programs, developing technical committee volunteers and keeping the Chapters better informed.

Reorganization of Board

In setting up the proposed Regions and Chapter Groups so as to get more equitable and constant regional representation on the Board, it became necessary to reorganize the Board itself. Thus it is proposed to increase the Directorate from the present 18 to 24, including the President, Vice-President, immediate past President and 21 other Directors. Eighteen of the 21 Directors will be named by a Nominating Committee for election in the usual manner at the Annual Convention. It is expected that all 18 Chapter Groups thus will be constantly represented on the Board.

However, it is known that many qualified men of broad executive and administrative experience are unable to participate actively in Chapter and technical committee work. Such men are needed to help guide the affairs of a Society of 11,000 members throughout the world and with an average annual budget exceeding $500,000. The AFS Board became convinced that only through direct approach could the services of such men be obtained. Therefore it is proposed that the Board shall appoint one Director annually, also for a 3-year term.

To accomplish these two plans, it is proposed to reduce the Nominating Committee from the present 9 members to 7, including the two immediate past Presidents as now, each of the other five representing one of the five proposed Regions. Selection of the Committee, and nominating procedures will remain essentially the same, except that means are provided to obtain more names of qualified Director candidates.

Other Notable Revisions

Among the other proposed by-laws changes, the Student and Apprentice membership class is to be replaced by a Junior Membership, with a single qualification of 25 years of age. This realistic provision should eliminate much confusion and enable young men entering the industry to become members while their earning power is

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AFS By-Laws Revisions

continued from page 102

low. Junior membership will not be contingent upon the holding of a Company membership.

Two other proposals affecting the Board of Directors have been discussed for several years. One provides that newly elected National Officers and Directors will take office immediately after the Annual Convention, instead of at the Annual Board Meeting some three months later. The other enables the Board to hold its annual meeting 90 days, instead of 30, following the close of the fiscal year on June 30. Preparation of the annual audit, budgets and annual reports have made the earlier date burdensome.

In a number of instances, rewordings have been recommended by the Society's attorneys, Ashcraft & Ashcraft of Chicago, to bring the by-laws more in line with the Society's exemption from Federal income tax and more in keeping with the status of AFS as a technical society. These provisions undoubtedly will be readily accepted by the members.

It should be added that no change in membership dues is involved in the proposed amendments, nor is one under consideration at this time.

The general by-laws revision proposed represents the work of many months and many hours of discussion and study by the Board Reorganization Committee, the By-Laws Committee and the Board of Directors. The two plans for regional organization and Board reorganization were recommended last March by the Board Reorganization Committee composed of Directors M. A. Fladoes, Chairman, A. L. Hunt and F. W. Shipley.

Development of Revisions

The two plans were considered at the Board meeting in March, approved and recommended to the By-Laws Committee to incorporate in the new by-laws to be proposed. The latter committee, with past President H. Bornstein as chairman, also included: past Presidents E. W. Horlebein and W. B. Wallis; past Director F. G. Sefing, and Directors A. D. Matheson, F. W. Shipley and E. C. Troy.

After meeting three times, the By-Laws Committee recommended to the Board a set of amendments essentially as now submitted but not incorporating the Board reorganization plan as originally developed. The consensus of the committee was that a 24-man Board was unwieldy and unnecessary, and that appointment of any Directors by the Board was objectionable.

All recommendations of the By-Laws Committee were approved by the Board on July 24, with the exception of those articles concerning Board reorganization. Here the Board adopted, and is now recommending to the membership, essentially the two inter-related plans as originally recommended by the Board Reorganization Committee.

In a letter accompanying the letter ballot mailed to all members in North America, AFS President Carter stated: "It is the considered belief of your Board, and of myself as President, that the membership can vote on these proposals with full confidence in the future of our Society."

AFS urges all members who received the ballot to *Vote Promptly*. All ballots to be counted must be received at the Central Office in Chicago not later than October 31.

When and if approved by the membership, the proposed by-laws amendments will become effective December 1, 1953. The 1953-54 Nominating Committee as announced elsewhere in this issue of AMERICAN FOUNDRYMAN will meet in December and put into immediate effect the new provisions of the proposed Regional organization and Board reorganization plans.

Chapter News

continued from page 79

nology and relate foundry processes to every day operations. The program is not intended for technical audiences but largely for young men in their junior and senior years in high school who are potential foundry employees.

The goal is to have every chapter purchase at least one program for the schools of their area. Cost is $100 and further information can be obtained from Earl Strick, chairman, educational committee, care of Erie Malleable Iron Co., Erie, Pa.

John E. Wolfe, new chairman of the Central Michigan Chapter, who presided at the chapter's board meeting held in August.

There was plenty to eat and drink aboard ship at the second Annual Crab Feast and Boat Trip of the Chesapeake Chapter held in July.

Chesapeake Chapter

L. H. GROSS
American Radiator & Standard Sanitary Corp.

Chesapeake Chapter held its second annual Crab Feast and Boat Trip in July. A capacity crowd of over 400 enjoyed the all day cruise down the Chesapeake Bay. A "Little German Band" composed of employes from the Chambersburg Engineering Co. supplied the music. Many visiting foundrymen from other neighboring foundrymen's societies attended.

A. A. Hockrein, Federated Metals, and Mike J. Kelly, Kelco Corp., were co-chairman for the party. This affair together with the annual oyster roast, held during the winter season, constitute the social program for the chapter.

Tentative plans for the Third Annual Educational Program of the chapter calls for a two day symposium to be held October 23-24, at the Engineers Club, Baltimore, Md. The theme for the meeting will be "Casting Defects and What to do About Them."

Directors attending the Detroit Chapter's board meeting held in August are, from left to right: Alexander A. Andrews, Otto Osterman, Roy Korpi and Samuel H. Cleland. Meeting was held to review the technical program for the coming year and to set up committees and lay plans for the coming year.

Twin-City Chapter

R. J. MULLIGAN
Archer-Daniels-Midland Co.

The Eighth Annual Golf Tournament and Dinner of the Twin-City Chapter was held August 3 at the Midland Hills Country Club, St. Paul, Minn. J. S. Garski, President, Progress Pattern and Foundry Co., St. Paul, directed the outing which drew 220 foundrymen and their guests out into the day-long rain.

Non-golfers enjoyed the facilities of the clubhouse during the golf tournament, which began at noon. Card
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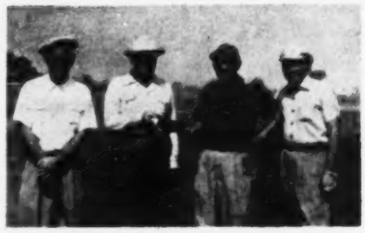
Paul Kordiak, Scott-Atwater Co., Minneapolis, receives the Twin-City Chapter golf trophy and congratulations from J. S. Garski, Progress Pattern & Foundry Co., St. Paul, Minn. The trophy is now Paul's personal possession, earned by being a three-time winner of the low-gross tournament. Seated at the speaker's table: left, Chapter Chairman O. J. Myers, Archer-Daniels-Midland Co., Minneapolis, and right, Mike Flaaten, Minneapolis Electric Steel Castings Co., Minneapolis.



Attending Southern California Chapter's Sixteenth Annual Summer Outing and Stag in August are, from left to right: Jack Crawford and T. V. Clifton, Independent Foundry Supply Co.; and Marley Oberlies and Jack Shearer, Hanford Foundry Co.

Chapter News

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games and refreshments were freely available throughout the day.

Following the dinner, golf and door prizes were awarded. The feature door prize was a Champion outboard motor, which was won by W. D. Murphy, Pioneer Engineering Co., Minneapolis.

Last year's low-gross golf tournament winner, Paul Kordiak, Scott-Atwater Co., Minneapolis, was awarded the chapter trophy as a three-time champion.

An individual trophy was awarded to Paul Younger, Western Alloyed Steel Co., Minneapolis, this year's low-gross champion.

Plans are under way for the coming year's chapter activity. The Educational Committee, again under the direction of J. D. Johnson, Archer-Daniels-Midland Co., met recently and began its plans for an even broader educational program than last year's very successful program.

Metropolitan Chapter

Members of the Student Chapter Advisory Committee to Polytechnic Institute of Brooklyn include the following:

George Staub, Metropolitan Brass Founders' Assn., Inc., William Z. Taylor, Taylor & Co., Robert V. Hunter, Archer-Daniels-Midland Co., Bernard N. Ames, U. S. Naval Shipyard, John M. South, Foundry Services Co. and A. J. Derrick, American Brakeshoe Co.

Eastern New York

Committee chairmen for the Eastern New York Chapter for the coming year

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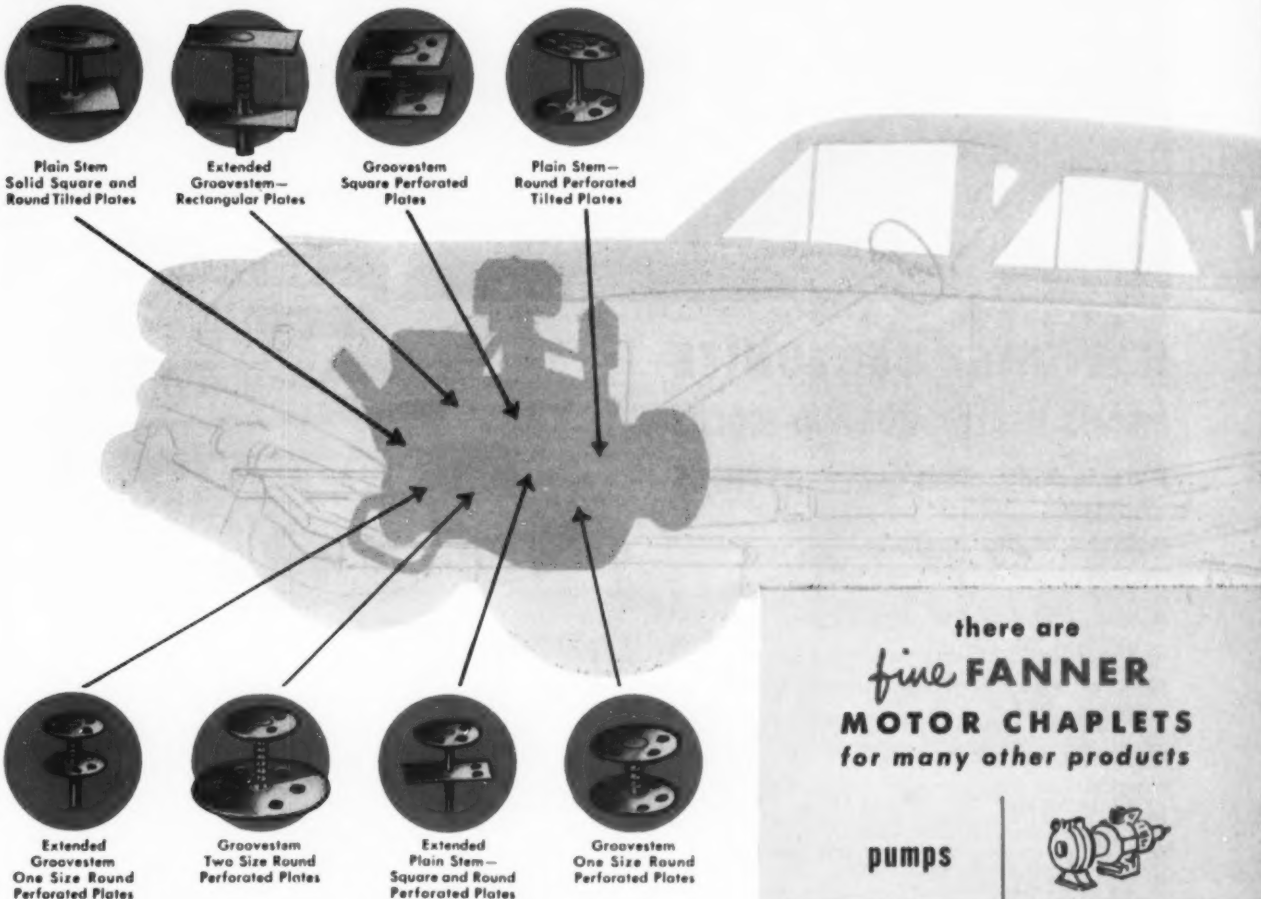
are used by more automotive manufacturers . . . in more locations . . . because of their outstanding record for producing sound, uniform castings



Products that are used by automobile manufacturers must pass the most rigid of tests. This is especially true of products involved in the casting operation because this industry depends on a gigantic continuous flow of uniform sound castings which form the heart of every motor car. Here, there can be no compromise with quality because unsound castings mean product failure and production line breakdowns. It is significant that for the past 30 years more fine Fanner Motor Chaplets have been used by more automotive manufacturers for more different castings than all other types combined. The millions upon millions of fine Fanner Motor Chaplets that have become an integral part of almost every motor car manufactured in the United States are proof of the close precision tolerances maintained, and the uniform high quality of these Fanner products. Fine Fanner Motor Chaplets through their exclusive design, their positive core support, their accuracy of construction, their complete fusion help produce better castings . . . at lower costs . . . with fewer losses . . . yet they cost no more! Only a few of the wide range of Motor Chaplets made by Fanner are shown—get acquainted with the complete line of Fine Fanner Chaplets by writing today for your free copy of the Fanner Chaplet Catalog.

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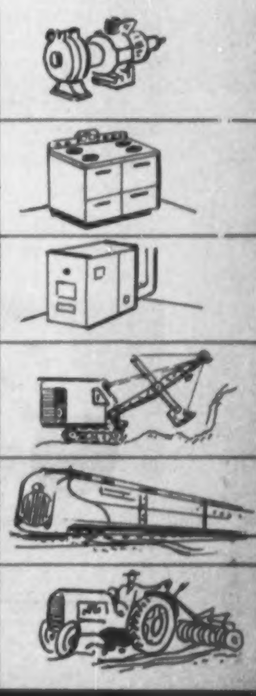

pumps

stoves

furnaces

road machinery

locomotives

farm machinery

Cast Armor Plant Closes

Operations at the government-owned Cast Armor Plant, East Chicago, Ind., will be brought to a close early in October, as a result of a reduction in the tank program. American Steel Foundries, operator of the plant for the government, is now taking steps to properly process and protect the equipment and buildings so that operations can be resumed on short notice, in the event a change in world conditions makes it necessary for the plant to be put back into production. The moth-balling is expected to be completed shortly after the first of the year. Plans are now in progress to use part of the plant facilities for warehousing purposes after the mothballing is completed.

Metals Science Club Elects Sam Tour as New President

The Metal Science Club of New York, an unusual organization of executives in science and industry with ten or more years' creative experience in metals technology, has elected a new panel of officers for the 1953-54 season.

The new president is Sam Tour, manager of Sam Tour & Co., Inc., a New York City industrial consulting, research and testing organization. Mr. Tour, a consulting metallurgist with 30 years' experience in the field, was last year's vice-president and is a charter member of the club. Howard S. Avery, American Brakeshoe Co., was elected as the club's vice-president; and John P. Nielson, professor of metallurgy at New York University, was elected to the post of secretary-treasurer.

Organized in 1946, the Metal Science Club meets regularly to discuss theoretical and technological aspects of metallurgy and metallurgical engineering. Guest speakers of outstanding competence in the metals field are invited to address the membership. At these meetings—usually held at the Town Hall Club—informal "ground rules" prevail, in that any member may interrupt the speaker at any point in his talk to clarify or debate a technical point. Membership in the club is by invitation and is limited to 125 persons of high professional accomplishment in the metals field.

Supplement Issued

Bringing up to date a previous publication on shell molding (PB-106640R), the office of Technical Services of the U.S. Department of Commerce has issued a supplement entitled "Shell Molding Patents and Recent Technical Literature." Also by Roy W. Tindula, chief of the Metals and Minerals Section, the supplement reviews patents in the United States, Great Britain, and Germany, lists suppliers of equipment molding resins, gives microfilm and other references.

Chapter News

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are as follows: Leigh M. Townley, membership; Earle W. Aumic, education; Donald G. Wheeler, chapter reporter; Howard Bodwell, chapter photographer, and William G. Stevenson, program committee.

Central Michigan

Plans for programs for the coming year for the Central Michigan Chapter were tentatively made at the Board Meeting of the chapter August 20. Some of the subjects to be covered during coming meetings will be: Non-Ferrous Metals, Mechanization of Core-Making, Costs, the "D" Process, and Human Relations. One meeting will be devoted to a Youth Encouragement Night.

Reporting for the Membership Committee, Don Gaertner said he expected to pass the target of 202 members by a substantial margin. He plans to assign one man in each plant as chairman to look after members in his plant. The committee expects to continue the use of attendance cards and will follow up each prospect.

In connection with the educational activities, AFS President Collins L. Carter, emphasized the importance of maintaining the high standards set in the previous year. We should especially, he said, emphasize technical training.

Chairman John E. Wolfe reported that an increase in the donation toward the new Headquarters Building, due to increased costs of construction, had been requested. A motion was made and carried that the chapter increase its pledge to $400.

Members attending the board meeting were: John E. Wolfe, Donald W. Gaertner, Gerald D. Strong, Collins L. Carter, Tom Lloyd, Don E. Champion, Lawrence M. Fagerlund, Carl J. Lofgren, Robert D. Dodge, Robert S. Hale, Art Van Emst, Lachlan Currie, Nick Jacobs, Stuart H. Yntema, Ralph Brooks, Roy A. Miller and Gardner R. Lloyd.

New Color Film Available

A new, full-color, 35 mm soundslide film, describing the patented ASARCO process for continuous casting of bronze rod, tubes and shapes, is available to interested groups without obligation. It may be obtained from Continuous-Cast Prods. Dept., American Smelting & Refining Co., Barber, N. J.

Obituaries

Werner Finster, 51, chief metallurgist for Textile Machine Works, Foundry Div., Reading, Pa., died August 13, at St. Joseph's Hospital, Reading, Pa. Mr. Finster was a member of AFS and A.S.T.M. and served on AFS subcommittee on Physical Properties of Steel Foundry Sands at Elevated Temperatures, as chairman for two years. He was a former member of T & O Committee, Special Committee and Metallurgical Committee, District No. 1. He was past president and director of Reading Foundrymen's Association. Prior to his association with Textile, he was Chief Metallurgist with American Chain and Cable Co. at their plant in Reading, Pa., known as Reading Pratt & Cady Div. Before that he was Foundry Metallurgist at the Tractor Div. of John Deere and Co., Moline, Ill., and prior to his association with Deere he was with Carus Chemical Co.

WERNER FINSTER

Ernest W. Shaw, vice-president of Freeman Supply Co., Toledo, Ohio, died recently. He was a member of AFS.

Seth E. Campbell, 57, sales engineer of J. S. McCormick Co., Pittsburgh, Pa., for 15 years, died suddenly while visiting relatives in Suffolk, Va.

William Ellsworth Clow, Jr., 68, Chicago manufacturer, was found fatally shot on his estate in Lake Forest, Ill., recently. Mr. Clow was chairman of James B. Clow & Sons, manufacturers of cast iron pipe and foundry supplies, and wholesalers of plumbing and heating supplies.

Chapter Meetings

October

1 . . Canton District
Mergus Restaurant, Canton, Ohio. C. V. Nass, Beardsley & Piper, Div. Pettibone Mulliken Corp., Chicago. *"Mechanization in Molding."*

8 . . Northeastern Ohio
Tudor Arms Hotel, Cleveland. Harry E. Gravlin, Jr., Ford Motor Co., Detroit. *"Sand, Metal or Men."*

9 . . Wisconsin
Hotel Schroeder, Milwaukee. General Meeting, Management.

16 . . Tri-State
Joplin, Mo. T. E. Barlow, Eastern Clay Products, Chicago. *"Casting Defects as Related to Sand Practice."*

21 . . Central Michigan
Hart Hotel, Battle Creek, Mich. T. E. Barlow, Eastern Clay Products, Chicago.

23-24 . . Chesapeake
Engineers Club, Baltimore, Md. Third Annual Educational Program. *"Casting Defects and What to Do About Them."*

26 . . Northwestern Pennsylvania
Moose Club, Erie Pa. Norman A. Birch, National Bearing Div., American Brakeshoe Co. *"Gating and Risering."*

A Warning

A woman-crazy paster took a crazy
  little core
To a whiskey-crazy molder on his crazy
  little floor.
The crazy molder took this core and set
  it, I am told,
In a crazy little core print in a crazy
  little mold.
What the molder didn't know was that
  this woman-crazy gent
Had pasted up that crazy core without
  a single vent.
The crazy heat gang poured it, and
  before that gang was through
The crazy core she blew, boys, Lordy!
  How she blew!
The crazy office questioned the
  foundry-crazy boss
About this crazy casting and the
  reason for its loss.
And that woman-crazy paster—perhaps
  you've guessed before—
That woman-crazy paster doesn't work
  here any more.

From the book Rammed Up and Poured, by Bill Walkins, copyrighted by the Electric Steel Foundry Co.

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HELP WANTED

PATENT ATTORNEY OR AGENT for handling a variety of matters in patent department of a large corporation having chemical and metallurgical activities and having main offices in New York; with general experience in patents, particularly in the preparation and prosecution of applications, appeals and interferences; preferably with engineering education and training in chemistry or metallurgy. Permanent position with good opportunities. Please give full information, including legal and technical education, age, marital status, year and state in which admitted to bar, experience and salary desired. **Box A46, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago 5, Ill.**

SALES REPRESENTATIVE—Supplies, Facings, Binders, Equipment. Rhode Island and Connecticut. We manufacture and Warehouse. Represent leading companies. Complete line including all equipment. Reply in detail in confidence. **Box A38, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago 5, Ill.**

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CORE ROOM FOREMAN experienced in steel foundry practice. In replying give complete information which will be held in strict confidence by a single executive. Address: **Box A37, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago 5, Ill.**

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